

DRAFT

REMEDIAL INVESTIGATION WORK PLAN FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MA



JUNE 2018

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Draft
Remedial Investigation Work Plan
for Per- and Polyfluoroalkyl Substances (PFAS)
Former Fort Devens Army Installation
Devens, Massachusetts

June 2018

CERTIFICATION:

I hereby certify that the enclosed Report, shown and marked in this submittal, is that proposed to be incorporated with Contract Number W912WJ-18-C-0011. This document was prepared in accordance with the U.S. Army Corps of Engineers (USACE) Scope of Work and is hereby submitted for Government approval.

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June 2018

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ACRONYMS AND ABBREVIATIONS

AAFES	Army Air Force Exchange Service
ABB	ABB Environmental Services, Inc.
AFFF	aqueous film forming foam
ANL	Argonne National Laboratory
AOC	area of contamination
ARCADIS	ARCADIS U.S., Inc./G&M, Inc.
Army	U.S. Army
BERS-Weston	BERS-Weston Services JVA, LLC
bgs	below ground surface
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, and xylene
°C	degrees Celsius
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
CSM	conceptual site model
CVOC	chlorinated volatile organic compound
DoD	Department of Defense
DQO	data quality objectives
DRFTA	Devens Reserve Forces Training Area
DRMO	Defense Reutilization and Marketing Office
EPH	extractable petroleum hydrocarbons
ERD	enhanced reductive dechlorination
ESD	Explanation of Significant Differences
FDSA	former drum storage area
FDW	former dry well
FS	Feasibility Study
FSP	Field Sampling Plan
GERE	Grant of Environmental Restriction and Easement
gpm	gallons per minute
GW	groundwater
HERA	Human and Ecological Risk Assessment
HHRA	human and health risk assessment
HGL	HydroGeoLogic, Inc.
HLA	Harding Lawson Associates
IWS	in-well stripping
J	estimated result
KGS	KOMAN Government Solutions, LLC
LHA	lifetime health advisory
LTM	long-term monitoring
LUC	land use control
MAAF	Moore Army Airfield
MassDEP	Massachusetts Department of Environmental Protection
MassDevelopment	Massachusetts Development and Finance Agency
MCP	Massachusetts Contingency Plan

MEP	Final Master Environmental Plan
mgd	million gallons per day
mL/g	milliliters per gram
MNA	monitored natural attenuation
ng/L	nanograms per liter
NIA	North Impact Area
NPL	National Priorities List
ORSG	Office of Research and Standards Guideline
PA	Preliminary Assessment
PCB	polychlorinated biphenyls
PCE	tetrachloroethene
PFAS	per- and polyfluoroalkyl substances
PFHpA	perfluoroheptanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluoronanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
POL	petroleum, oil, lubricants
PVC	polyvinyl chloride
QA/QC	quality assurance/ quality control
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
ROD	Record of Decision
SA	Study Area
SAP	Sampling and Analysis Plan
SHP	Shepley's Hill Landfill
SI	Site Inspection
SSI	Supplemental Site Inspection
SVE	soil vapor extraction
TPH	total petroleum hydrocarbon
TPHC	total petroleum hydrocarbon content
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tank
VOC	volatile organic compound
WP	work plan
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

This Remedial Investigation (RI) Work Plan (WP) for per- and polyfluoroalkyl substances (together, “PFAS”) at the Former Fort Devens Army Installation (Devens) located in Devens, Massachusetts has been prepared by KOMAN Government Solutions, LLC (KGS) on behalf of the United States Army Corps of Engineers, New England District (USACE).

The RI is occurring under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act, and National Oil and Hazardous Substances Contingency Plan (NCP) requirements, with regulatory coordination of the Massachusetts Department of Environmental Protection (MassDEP) and the United States Environmental Protection Agency (USEPA).

PFAS are used in many industrial and consumer applications and are a component of aqueous film forming foams (AFFF) used to extinguish oil and gas fires at a variety of locations including airfields. In industrial and consumer applications PFAS are used to make carpets, clothing, fabrics for furniture, paper packaging for food and other materials (e.g., cookware) that are resistant to water, grease or stains (MassDEP, 2018). The USEPA has identified PFAS as an “emerging contaminant of concern” and, in May 2016 issued a lifetime health advisory for drinking water of 70 nanograms per liter (ng/L) for the combined concentrations of perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) (USEPA, 2016a, 2016b).

Through a Basewide Preliminary Assessment (PA) of PFAS at Devens, some Study Areas (SA) and Areas of Contamination (AOC) were identified where there was a potential for the use, storage, or disposal of AFFF. A subsequent Site Inspection (a.k.a., Site Investigation, or SI) and SI addendum confirmed the presence of PFAS in groundwater, soil, surface water and sediment at several SAs and AOCs. Sampling of existing long-term monitoring wells at select AOCs confirmed the presence of PFAS at some AOCs not identified in the preliminary assessment. Based on the results of the site inspection, site inspection addendum, and the sampling of long-term monitoring wells, the areas listed below were identified for inclusion in the RI. The SA designation was changed to an AOC designation as sites were included in the RI. Impacted water supply wells, specifically the Grove Pond wellfield and MacPherson water supply wells, are also included for investigation as part of the RI.

The overall objectives of the RI are to:

- Define the nature and extent of PFAS in groundwater, soil, surface water, and sediment at or originating from former Fort Devens (“Devens”), including evaluations of potential continuing sources of PFAS contamination to those environmental media.
- Evaluate PFAS migration from Devens to the Grove Pond and Devens public water supply wells and determine whether other public or private water supply wells have been impacted by PFAS migrating from Devens.
- Update and refine the conceptual site model (CSM), including actual and potential exposure pathways.

- Conduct a quantitative HHRA and a qualitative ecological risk evaluation, which will be completed to estimate potential human health and ecological risks associated with exposure to PFAS in groundwater, soil, surface water, and sediment.
- Collect appropriate data to support a feasibility study under CERCLA.

To expedite the field investigations, the identified AOCs, Grove Pond wellfield, and MacPherson water supply well areas were grouped into three areas (Areas 1, 2, and 3). Area 1 consists of:

- AOC 57 Building 3713 Fuel Oil Spill Site;
- AOC 74 Barnum Road Firefighting Exercise Site;
- AOC 75 Former Building T-1445 Warehouse Fire; and,
- Grove Pond wellfield.

Area 2 consists of:

- AOC 5 Shepley's Hill Landfill;
- AOC 32/43A Former Defense Reuse and Marketing Office (DRMO)/ Petroleum, Oil, Lubricants (POL) Storage Area;
- AOC 43G Historical Gas Station G;
- AOC 43J Historical Gas Station J;
- AOC 76 Devens Fire Station; and,
- MacPherson water supply well.

Area 3 consist of:

- AOC 50 former Moore Army Airfield (MAAF);
- AOC 30 MAAF fire training area;
- AOC 31 MAAF drum storage area;
- AOC 20 Waste Water Treatment Plant Sand Filter Beds; and,
- AOC 21 Waste Water Treatment Plant Sludge Drying Beds.

Three Area-Specific Field Sampling Plans (FSP) will be provided as addenda to the RI WP in a sequential manner, allowing field mobilization upon approval of the applicable FSP. The FSP addenda provide the details regarding the proposed sampling program for each AOC to include the sampling design and rationale, and the sampling locations and methods.

The Uniform Federal Projects Quality Assurance Project Plan (QAPP) (appended to the RI WP) and the Human Health and Ecological Risk Assessment (HERA) Work Plan Addendum are applicable to all three areas. The Area-Specific FSP addenda and the QAPP together serve as the sampling and analysis plan.

1.0 INTRODUCTION

KOMAN Government Solutions (KGS), on behalf of the U.S. Army Corps of Engineers (USACE) New England District, has prepared this work plan (WP) for conducting a Remedial Investigation (RI) for per- and polyfluoroalkyl substances (together, “PFAS”) at the former Fort Devens Army Installation (Devens) located in Devens, Massachusetts (Figure 1-1). The areas of contamination (AOC) addressed in this RI WP are shown on Figure 1-2.

1.1 Background

The United States Environmental Protection Agency (USEPA) has identified PFAS as an “emerging contaminant of concern” and, in January 2009, established a provisional lifetime health advisory (LHA) for perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA), which were components of aqueous film forming foams (AFFF) used to extinguish oil and grease fires at a variety of locations including airfields. PFOS and PFOA are also present in a variety of consumer products. In industrial and consumer applications PFAS are used to make carpets, clothing, fabrics for furniture, paper packaging for food and other materials (e.g., cookware) that are resistant to water, grease or stains (MassDEP, 2018). In May 2016, the USEPA issued a LHA for drinking water of 70 nanograms per liter (ng/L) for the combined concentrations of PFOS and PFOA following toxicity studies (USEPA, 2016a, 2016b).

Investigations related to PFAS at Devens began in 2016 with a Preliminary Assessment (PA) to determine if there were potential historical releases of PFAS at Devens. Areas that warranted further investigation based upon previous use and disposal of PFAS were identified in the PA (KGS, 2017c) and it was concluded that potential PFAS impacts should be further investigated under a Site Inspection (aka Site Investigation or SI), pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In 2017, the Army conducted a SI to determine the presence or absence of PFAS in soil, groundwater, and/or sediment and surface water at selected site at Devens. Based on the results of the SI it was recommended that a RI be performed at numerous sites (BERS-Weston, 2018a).

Devens is located in the towns of Ayer and Shirley in Middlesex County, and the towns of Harvard and Lancaster in Worcester County, Massachusetts, approximately 35 miles northwest of Boston, Massachusetts (Figure 1-1). The installation occupied approximately 9,260 acres. Fort Devens was divided into the North Post, Main Post, and South Post. Route 2 divides the South Post from the Main Post. The Nashua River runs through the North, Main, and South Posts. The area surrounding Devens is primarily comprised of rural residential properties. Portions of Devens have been redeveloped for commercial/industrial use.

1.2 Site History

Camp Devens was established in 1917 as a temporary training area for soldiers during World War I. In 1932, the site was named Fort Devens and made a permanent installation with the primary mission of commanding, training, and providing logistical support for non-divisional troop units. Fort Devens was used for a variety of training missions between 1917 and 1990. Pursuant to the CERCLA, Fort Devens was placed on the National Priorities List on November 21, 1989, due to environmental contamination at several sites.

Fort Devens was identified for cessation of operations and closure under Public Law 101-510, the Defense Base Realignment and Closure (BRAC) Act of 1990, and officially closed in March 1996.

As part of the Devens BRAC program, portions of the property formerly occupied by Devens were retained by the U.S. Army (Army) for reserve forces training and renamed the Devens Reserve Forces Training Area (DRFTA). Areas not retained as part of the DRFTA were transferred to new owners, the Massachusetts Development and Finance Agency (MassDevelopment), U.S. Department of Labor, U.S. Department of Justice, and the U.S. Fish and Wildlife Service (USFWS), for reuse and redevelopment. In 2009, the DRFTA was renamed the U.S. Army Garrison Fort Devens.

The following sections summarize the Army's past environmental investigations conducted at the CERCLA AOCs that were identified for further investigation of PFAS under this RI.

1.2.1 AOC 5 Shepley's Hill Landfill

Shepley's Hill Landfill (SHL) is located in the northeast corner of the former Main Post of Devens and occupies 84 contiguous acres (Figure 1-2 and 1-3). The landfill is bordered to the east by Plow Shop Pond and land formerly containing a railroad roundhouse, to the west by Shepley's Hill, to the south by recent commercial development and AOC 32, and to the north by wooded and residential areas. Nonacoicus Brook, which drains Plow Shop Pond to the Nashua River, is located north of the landfill, and is identified as the northern boundary of what is called the North Impact Area (NIA) (i.e., the area downgradient of the landfill with groundwater that is believed to have been impacted by the presence of SHL).

There is an extensive investigative, remediation, and monitoring history at SHL. A brief orientation to SHL is provided below with greater detail available in referenced documents. The SHL is comprised of three AOCs. The 1995 Record of Decision (ROD) for SHL addresses AOC 4 which is the former sanitary landfill incinerator, located within former Building 38 near the end of Cook Street; AOC 5 which is the sanitary landfill No. 1; and AOC 18 which contains the asbestos disposal cell. AOCs 4 and 18 are located within the capped area of SHL and all three AOCs are collectively referred to as SHL (USAEC, 1995) and in this document reference to AOC 5 includes AOCs 4 and 18.

The Army began landfill operations in the 1940s, although test pit evidence indicates that earlier use as a landfill was highly probable (ANL, 1992). The landfill was in a former wetlands area and formerly operated as an open burning site (ANL, 1992). Landfill operations ceased as of July 1, 1992. The principal waste types in SHL include incinerator ash, household refuse, glass, construction debris, asbestos-containing materials, and spent shell casings. Army documentation indicates that no hazardous wastes were disposed of in SHL after November 19, 1980. The Massachusetts Department of Environmental Protection (MassDEP) approved the closure plan in 1985 and the Army capped the landfill in accordance with Massachusetts Regulations 310 CMR 19.000. The landfill was closed in five phases between 1986 and 1993 and was capped with a 30 to 40-mil polyvinyl chloride (PVC) membrane and overlying soil cover. In 2006, the Army commenced operation of a groundwater extraction and treatment system to address arsenic contamination in groundwater emanating from the landfill toward the NIA. Two extraction wells and the treatment plant were constructed at the north (downgradient) end of the landfill. It was later determined that the landfill cap and groundwater extraction system did not eliminate groundwater flow and arsenic migration from SHL into Red Cove at Plow Shop Pond. In 2012, the Army installed a low permeable groundwater barrier wall through the overburden to the

bedrock surface to mitigate landfill contaminant migration to Red Cove (Sovereign, 2013b) (Figure 1-3).

A chronology of relevant regulatory-related events pertaining to AOC 5 is summarized below.

Chronology of Events at Shepley's Hill Landfill

Event	Date
The Army initiates the Fort Devens Sanitary Landfill Closure Plan	1984
Devens placed on NPL	December 1989
Waste disposal at Shepley's Hill Landfill ends	July 1992
Landfill capping complete	May 1993
Remedial Investigation (RI) and Supplemental RI complete	December 1993
Feasibility Study (FS) complete	February 1995
Record of Decision (ROD) complete	September 1995
Supplemental Groundwater Investigations complete	May 2003
Draft Explanation of Significant Differences (ESD)	February 2004
Performance Work Statement for Comprehensive Site Assessment and Corrective Action Alternatives Analysis	March 2005
Final ESD for implementation of the Contingency Remedy	June 2005
SHL Contingency Remedy Long-Term Operations, Maintenance, and Monitoring commences. Arsenic treatment plant begins operations.	March 2006
SHL Contingency Remedy – GW extraction pumping rate increased from 25 gallons per minute (gpm) to 45-50 gpm	June 2007
Draft Final SHL Supplemental GW & LF Cap Assessment for Long-Term Monitoring and Maintenance Report (SAR) completed	June 2009
Draft Focused FS for SHL Remedy Update (formerly CAAA)	September 2009
Final Removal Action Completion Report for SHL barrier wall	July 2013
Final ESD – Land Use Controls to restrict groundwater use in NIA	December 2013

1.2.2 AOC 20 Waste Water Treatment Plant Sand Filter Beds and AOC 21 Waste Water Treatment Plant Sludge Drying Beds

The Devens Waste Water Treatment Plant (WWTP) is located in the former North Post area southwest of the Nashua River and former Moore Army Airfield (MAAF) (Figures 1-2 and 1-4). The WWTP was constructed by the Army in 1942 and is still in operation by MassDevelopment. Three components of the WWTP were initially identified as Study Areas: Imhoff tanks (SA 19), rapid infiltration beds (SA 20), and sludge drying beds (SA 21) (ANL, 1992) (ABB, 1993a).

The WWTP has a design capacity of 3.0 million gallons per day (mgd). The average daily flow was about 1.3 mgd (KGS, 2017c). Less than 1 percent of the flow was from industrial sources, including vehicle wash rack discharge, caustic radiator wash water, floor drains, heating plant boiler blowdown, and swimming pool filter backwash (ANL, 1992) (KGS, 2017c).

Wastewater is carried to the main pumping station via a gravity-flow sanitary sewer and several small pump stations (KGS, 2017c). At the main pumping station, the wastewater is pretreated by passing through a bar screen, grit chamber, and comminutor. The wastewater is then pumped to

three parallel Imhoff tanks (settling tanks and sludge digestors), a dosing tank, 22 rapid infiltration sand beds (0.8 acre each), and four sludge drying beds. The primary effluent from the Imhoff tanks discharges into a dosing tank, which intermittently applies wastewater to rapid infiltration basins. The infiltration basins are used in rotation. The application cycle involves discharge to nine basins for nine days, to another seven basins for seven days, and to the remaining six basins for six days (KGS, 2017c). The application rate for each rapid infiltration basin was calculated to be about 25-28 meters per year (ANL, 1992) (KGS, 2017c). Sludge from the Imhoff tanks is drained to four uncovered sludge drying beds two to three times annually. The sludge drying beds were equipped with 4-, 8-, and 10-inch clay pipe underdrains to collect supernatant. Before 1982, the supernatant was discharged to an adjacent wetland area located on the east bank of the Nashua River. After 1985, supernatant was collected and pumped back into an infiltration basin. Because these pipes have collapsed over the years and the sludge drying beds are located on the kame deposit, it is likely that most of the supernatant infiltrates into the permeable subsurface. In the past, dried sludge, typically about 70 percent solids, from the sludge drying beds was removed and applied to the land at the former MAAF per the requirements of a state Class EH Sludge application permit. Land application of dried sludge from the sludge drying beds at the former MAAF is no longer conducted (ANL, 1992, ABB, 1993a). The WWTP has been upgraded to provide advanced treatment (secondary treatment, nitrogen removal, and disinfection) through sequence batch reactors and ultraviolet disinfections (Nashua River Watershed Association, 2018). The WWTF is designed to treat 3 mgd of wastewater and is operated under a MassDEP groundwater discharge permit. The upgraded WWTF has been in operation since September 2001 and treats less than 1 mgd of wastewater from Devens and the Massachusetts Correctional Institution in Shirley. The treated effluent is discharged to the groundwater via rapid infiltration beds (Nashua River Watershed Association, 2018).

Wells have been installed at the site for past investigations and/or monitoring. Twenty observation wells were installed in 1974. These wells, which are no longer in use, provided data on water elevation and effectiveness of the infiltration beds (KGS, 2017c ANL, 1992). The 1992 Enhanced Preliminary Assessment (Weston, 1992) noted that the “current” monitoring well network consists of 16 wells. Wells 1 through 4 were installed in 1984, and wells 1a and 2a were installed in 1988. Wells 5 through 14 were installed in 1991 (Weston, 1992). The groundwater is monitored through wells placed up and downgradient of the discharge. The Nashua River is also monitored six times per year upstream and downstream of the discharge, and no noticeable impact to the river has been reported (Nashua River Watershed Association, 2018).

The WWTP, sand infiltration beds, and sludge drying beds were included as part of the Devens PFAS PA (KGS, 2017c). No specific information related to the disposal of AFFF firefighting materials or cleaning of firefighting equipment to the sanitary sewer system were found in historical reports or interviews with persons of knowledge (KGS, 2017c). A review of reports conducted on the storm water collection system at the former MAAF indicated the storm drains did not connect to the sanitary sewer system (ADL, 1994; KGS, 2017a). But the sand infiltration beds and sludge drying beds were identified as a potential Army PFAS source due to the potential past disposal of AFFF compounds via the municipal sewer system and the WWTP was not designed to remove PFAS (KGS, 2017c). Therefore, the sand infiltration beds (SA 20) and sludge drying beds (SA 21) were included in the SI to further assess whether PFAS was present at these locations (KGS, 2017a). The designation of SA 20 and SA 21 was changed to AOC when these sites were included in this RI.

1.2.3 AOC 30 Former Moore Army Airfield Drum Storage Area

The former Drum Storage Area is located in the former North Post area at former Moore Army Airfield (MAAF) (Figures 1-2 and 1-5). The former MAAF Drum Storage Area is comprised of two locations north of the main airfield runway (Figure 1-2 and 1-5). These areas were used for drum storage, including 55-gallon drums of firefighting foam concentrate.

The Drum Storage Areas at the former MAAF were initially identified as SA 30 based on historical uses and potential contamination (ANL, 1992). Three small areas located in the northern part of the airfield were reportedly used for temporary storage of hazardous waste between 1975 and 1990 (KGS, 2017c PA). The Drum Storage Areas were originally thought to be located at two nearby areas at the end of the aircraft defueling area (west drum storage area). More recently, it has been learned that drums were stored in that location only for the later years. Previous to that and for a longer period, drums of waste were stored at a location farther to the east (KGS, 2017c).

The west temporary drum storage area was an outdoor satellite accumulation point for storage of containerized hazardous waste for 90 days or less. Pallets with space for ten to fifteen 55-gallon drums were positioned at the end of the aircraft defueling area (KGS, 2017c). During 1990, Fort Devens constructed a prefabricated 90-day storage area at another location, and the area is no longer in use (KGS, 2017c).

This area was used to store materials such as alkaline cleaners (USEPA waste D002), methyl ethyl ketone (FO05), contaminated JP-4 jet fuel (DO01), and paint thinners (DO01, D008) (KGS, 2017c). During the ANL site assessment in 1988, the following materials were being stored at this site: naphtha, dry cleaning solution (such as PD-680), JP-4, aircraft cleaning compounds, lube oil, and waste solvent (F-listed wastes). The JP-4 drum was resting on asphalt rather than on the pallet. In addition to these materials, five empty drums were present (out of a total of 21 drums). Several drums were damaged. The drums were all exposed to the natural elements, and ponding was evident on the drum tops (KGS, 2017c).

The former airfield including the former Drum Storage Area is currently leased by the Massachusetts State Police for training and vehicle storage. No drums are currently stored in the former Drum Storage Area. Reviews conducted of available historical documents did not indicate the storage of AFFF or fire suppressant foams; however, interviews conducted with persons knowledgeable of previous site activities indicated foams were stored and used for firefighting training (KGS, 2017c).

A SI conducted on August 19, 2016 found no AFFF stored on site. In addition, Massachusetts State Police personnel were interviewed, and they do not use AFFF or foam during training activities or in the event of a car fire. They utilize Class B powder extinguishers (KGS, 2017c).

AFFF may have been potentially used at the former MAAF and stored at SA 30. This area was used historically for training military and municipal personnel on the use of firefighting foams related to Class B fires (KGS, 2017c). The PA also determined the groundwater, surface water, and sediment pathways are complete or potentially complete. Therefore, it was recommended that a SI be performed to determine if additional action is required (KGS, 2017c). The designation of SA 30 was changed to AOC when this site was included in this RI.

1.2.4 AOC 31 Former Moore Army Airfield Fire Training Area

The former MAAF firefighting area is located in the former North Post area at former Moore Army Airfield (MAAF) (Figures 1-2 and 1-5). The former MAAF firefighting training area was initially identified as SA 31 based on historical uses and potential contamination. SA 31 was located on an abandoned portion of the airport runway (Figure 1-2 and 1-5). SA 31 was included as part of the PFAS PA at Devens due its previous use as a firefighting training area. The area, which was used between 1975 and 1986, consists of a 50- by 50-ft asphalt-covered concrete pad that is eight inches thick. The pad is surrounded by a 12-inch high by 24-inch wide earthen containment berm (KGS 2017 PA).

The center of the pit contained the shell of a U-8 airplane that was used during firefighting training exercises. Fuels used during the training included contaminated fuel and paint thinner. No discharge of fuel from the training pit was reported. Other disposal activities at SA 31 included burning of fuel samples from the laboratory about once per year (KGS, 2017c).

The former airfield including the former Drum Storage Area is currently leased by the Massachusetts State Police for training and vehicle storage. Currently, the firefighting training area is not in use. Interviews conducted with the Devens Fire Chief indicated that AFFF foam was historically used during firefighting training exercises. Based upon interviews with the Devens Fire Chief, fire suppression foams were mixed with water, placed in a pump tank, and then transported to the training area for use (KGS, 2017c). Interviews with the Massachusetts State Police indicated firefighting foams are not used during their driver training activities.

Since AFFF was used at SA 31 and the PA determined the groundwater, surface water, and sediment pathways are complete or potentially complete; it was recommended that a SI be performed (KGS, 2017c). The designation of SA 31 was changed to AOC when this site was included in this RI.

1.2.5 AOC 32/43A Former Defense Reuse and Marketing Office/Petroleum, Oil, Lubricants Storage Area

AOCs 32 (former DRMO Yard) and 43A (former POL Storage Area) are located in the northeast portion of the former Main Post of Devens (Figure 1-2).

AOC 32 is located in the northeast portion of the former Main Post of Devens (Figures 1-2 and 1-6). AOC 32, formerly known as SA 32, historically consisted of three fenced areas (West Yard, East Yard, and Tire Recycling Area) along Cook Street (Figure 1-7). The West Yard, a paved area formerly used for the storage of used equipment containing lead-acid batteries, as well as for storage of telecommunications and administrative equipment; the former East Yard, a paved area that was used for disassembling vehicles for reusable parts; and the Tire Recycling Area, an unpaved area used for the storage and recycling of tires. Records indicated that the facility was actively used by the Army from approximately 1964 to 1995 (KGS, 2017c). In addition, a former waste oil underground storage tank site, located just northeast of the former DRMO Office, was also incorporated into AOC 32.

In 1991, a SI was performed at the DRMO Yard. Two operable units were included, a soils operable unit, that included the excavation and off-site disposal of soil and a groundwater operable unit associated with a waste-oil UST. Excavated soils were removed from the East Yard and the former Tire Recycling Yard (KGS, 2017c). Analytical findings of the SI reported xylene and petroleum contamination in soil and groundwater.

In 1994, a RI was conducted and concluded that soil and groundwater contamination at the site required further remedial action (E&E, 1994). Potential remedial alternatives were presented in a FS and the preferred alternative was presented in a PP. The ROD documented the final choice of remedy for cleanup of soils by excavation with off-site disposal and cleanup of groundwater by monitored natural attenuation (MNA) (Horne, 1998). Remedial actions for the soil included the removal and disposal of metal debris; the removal and disposal of soil contaminated with petroleum, pesticides and lead; and the removal and disposal of non-hazardous soil containing shredded tire scrap (S&W, 2000a).

In 1999, MNA field activities commenced at AOC 32 and a final assessment and recommendations report concerning the effectiveness of the MNA based on ROD criteria was presented in February 2000. The report determined that natural attenuation, supplemented with long-term groundwater monitoring and the establishment of institutional controls, would be an effective remedial action for AOC 32 (S&W, 2000c). Monitoring of the groundwater at the site has continued and the results reported on an annual basis.

AOC 43A, during the 1940s and 1950s, was a fenced lot that served as a distribution facility for all the gasoline stations at Fort Devens. The distribution facility formerly consisted of a main gasoline station, a pump house (former building T-401) with five fuel USTs and four fuel aboveground storage tanks (ASTs), railroad tracks, an asphalt driveway led into the POL Storage Area from Antietam Street (Figure 1-6 and 1-7) (S&W, 1998).

Between 1965 and 1972, four fuel oil ASTs were removed from AOC 43A. In 1989 and 1990, five fuel oil USTs were located, and the adjacent soils were excavated and removed from the site, respectively. Five USTs and 800 cubic feet of contaminated soil was removed from the site. Total petroleum hydrocarbons (TPH) was detected in soil collected during the excavation (E&E, 1994b). This remedial action removed the source from AOC 43A.

In 1991, five new USTs were installed in the POL Storage Area and were used to store fuel for military vehicles. In 1992, the Army conducted a SI and reported low levels of xylene and elevated petroleum in subsurface soils. In 1994 a RI was conducted to determine the nature and distribution of the detected contamination. Findings of the RI concluded that groundwater contamination required a remedial action evaluation (S&W, 2000b). Potential remedial alternatives were presented in a FS and the preferred alternative was presented in a PP. The 1998 ROD documented the final remedy choice of institutional controls and MNA long-term monitoring (Horne, 1998).

AOC 32 and AOC 43A were redeveloped to include paved areas and a large warehouse constructed in 2001 (Nobis, 2005). The current owner, O'Reilly Auto, purchased the property in 2013.

1.2.6 AOC 43G Historical Gas Station G

AOC 43G is located in the central portion of the former Main Post of Devens. It is located at the southwestern corner of Feinburg Road and Queenstown Street (Figures 1-2 and 1-8). AOC 43G consists of the former Army Air Force Exchange Service (AAFES) gas station (Areas 2 and 3) and historical Gas Station G (Area 1) and has been the subject of SIs and RIs due to petroleum contamination in soil and groundwater resulting from the past operations (ABB, 1996e) (H&S, 2015).

Originally, AOC 43G consisted solely of historical gas station G, which was one of eighteen historical gas station sites at Devens. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late

1940s or early 1950s. No records were available on the decommissioning of the motor pool and therefore, there was no evidence of the exact location of gas station G or that the station's underground storage tank (UST) had been removed (ABB, 1996e).

The reported location of gas station G was southwest of the former AAFES gasoline station (Building 2008) and southwest of Building 2009. The structures of gas station G consisted of a pump island and a small gasoline pumphouse. Reportedly, the gas station had one 5,000-gallon (or possibly 5,140-gallon) UST located between the gasoline pumphouse and the pump island (ABB, 1996e).

AOC 43G was expanded to include the former AAFES gas station after the SI was completed in 1993. The AAFES gas station was added to further define the distribution of contamination detected during the past gasoline UST removals (completed in 1990), as well as the contaminants detected during a waste oil UST removal completed in 1992 (ABB, 1996e).

The location of the former AAFES gasoline station is approximately 120 ft northeast of the site of historical gas station G. At the time of the 1992 SI and 1993 Supplemental Site Inspection (SSI), it consisted of a service station (Building 2008), which housed three vehicle service bays and the AAFES store. It also included three, 10,000-gallon USTs, associated pump islands, and a sand and gas trap (Area 3) (H&S, 2015). The 10,000-gallon gasoline USTs, and associated piping, were removed in July/August 1996. The sand and gas trap and residual soil contamination in Area 3 were also removed during this Removal Action (ABB, 1996e).

Based on the results of the 1992 and 1993 SI, supplemental SI (SSI), and revised human health Preliminary Risk Evaluation associated with the SSI, no further action was recommended for Area 1 (historical gas station G) (ABB, 1996a). The Army and USEPA signed a ROD in 1996 documenting the selection of intrinsic remediation with long-term monitoring (LTM) as the selected remedy. The major components of the selected remedy included intrinsic bioremediation, intrinsic bioremediation assessment data collection and groundwater modeling, installing additional monitoring wells, long-term groundwater monitoring, annual data reports to USEPA and MassDEP, and 5-year reviews. Intrinsic bioremediation is the principal component proposed to prevent COCs that exceed groundwater cleanup levels from potentially migrating off Army property (ABB, 1996e, Sovereign/HGL, 2015).

1.2.7 AOC 43J Historical Gas Station J

The Army historically used AOC 43J as a gas station/motor pool and subsequently as a vehicle storage yard and maintenance facility for Fort Devens. AOC 43J is located in the northwest quadrant of the Queenstown Street and Patton Road intersection (Figures 1-2 and 1-9). The property at AOC 43J was transferred to MassDevelopment in 2006 as a condition of Bristol Myers Squibb's (BMS) commitment to develop facilities at Devens. USEPA and the MassDEP currently administer AOC 43J jointly (Haley and Aldrich, 2017).

AOC 43J was first identified as a possible source of contamination in 1988 (ANL, 1992). The Army identified several leaking USTs which held gasoline, waste oil, and diesel. At the time of base closure in 1996, the area around AOC 43J was used as a vehicle storage yard and maintenance facility (former Buildings T-2446 and T-2479) for a Special Forces Unit of the Army. The former maintenance facility used a 1,000-gallon UST for storage of maintenance wastes. This UST was located just south of former Building T-2446 (Haley and Aldrich, 2017).

Prior to construction of the vehicle maintenance facility, this area had been used as a gas station/motor pool (gas station J) during the 1940s and 1950s. The structures of this historical gas station consisted of a pump island and a small gasoline pump house. This gas station was reported to be a Type A station, with one 5,000-gallon UST located between the gasoline pump house and pump island. The station was used during World War II as a vehicle motor pool to support military operations. The motor pool operations were discontinued during the late 1940s or early 1950s. No records were available on the decommissioning of this motor pool or the removal of the associated UST (Haley and Aldrich, 2017).

In 1991, Site Investigations at 13 SAs at Devens including historical gas stations were conducted (ABB, 1993b). Based on the results of the SIs at these SAs, the Army decided to conduct SSIs at 14 of the original 32 SAs (ABB, 1996b). Upon completion of the Supplemental Data Package it was recommended that three SAs (SA 41, 43G, and 43J) should progress to the RI and FS phase. The name designation for each of these SAs were administratively changed to AOCs (i.e., AOC 43J).

During the 1992 SI, an abandoned 5,000-gallon UST was found in the area of the historical gas station J. This UST was added to the Devens UST removal program and removed in August 1992. The former waste oil UST was also removed during May of the same year. During both UST removals, contaminated impacted soil was removed and disposed of by the Army. Based on the data and the findings of the 1992 SI, additional investigation was recommended (ABB, 1996d).

The RI was conducted to evaluate the nature and distribution of the contamination in soil and groundwater downgradient and cross-gradient of the former waste oil and historical gas station USTs. Based on the results and interpretations of the RI and the human health risk assessment (HHRA), it was recommended that a FS be performed to evaluate alternatives to reduce potential human health risks associated with potential future exposure to groundwater at the source area directly downgradient of the former UST locations.

The FS Report identified and screened response actions and potential remedial technologies that were capable of attaining the remedial action objectives (ABB, 1996c) and the preferred alternatives was presented in a PP. The ROD documented the final choice of remedy Intrinsic Bioremediation, which included: intrinsic bioremediation (i.e., MNA), intrinsic bioremediation assessment data collection and groundwater modeling, installing additional groundwater monitoring wells, long-term groundwater monitoring, annual data reports to USEPA and MassDEP, and five-year reviews (ABB, 1996e).

An Intrinsic Remediation Assessment was completed in 1999 to assess the effectiveness of the selected alternative (Intrinsic Bioremediation) at AOC 43J (S&W, 1999). The assessment concluded that intrinsic remediation was demonstrated to be an effective remedial action at AOC 43J and no contingency action was required at that time. Future actions would consist of implementing the remaining components as specified in the ROD (including a long-term monitoring program, annual reporting, and 5-year reviews) (S&W, 1999).

In 2006, an Explanation of Significant Differences (ESD) (U.S. Department of Army, 2006) was completed following a Finding of Suitability for Early Transfer (FOSET) and addresses the changes that are necessary for the remedy to remain protective of human health and the environment. The purpose of the ESD was to allow land use controls to be implemented to allow property to be transferred from Army to MassDevelopment. AOC 43J property was transferred

from the Army to MassDevelopment in June 2006. The land use controls were detailed in a June 2006 Grant of Environmental Restriction and Easement (GERE) issued by MassDEP.

It was noted during a five-year review that MNA would not reach the ROD goals within the required 30-year performance period, and therefore subsequent pilot testing of remedial-amendment injections were performed using two separate pilot tests during 2010 and 2011 (Haley and Aldrich, 2015). These tests concluded that sodium persulfate/calcium peroxide would provide short-term oxidation and long-term reduction processes to augment MNA to reduce petroleum-related contaminant concentrations remaining at the site. Remedial-amendment injections of sodium persulfate/calcium peroxide were performed during 2012 and subsequent groundwater sampling conducted in 2013 and 2014 indicated that BTEX concentrations had generally decreased over time in most monitoring wells; however, continued monitoring was recommended (Haley and Aldrich, 2015 and 2017).

1.2.8 AOC 50 Former Moore Army Airfield

AOC 50 is at the former MAAF located within the former North Post (Figures 1-2 and 1-5). The former MAAF was used for military purposes and the main portion consisted of two fixed wing runways, two rotary wing runways, a parking area for 15 rotary-wing aircraft, and aircraft hangar (Building 3816) (Figures 1-5, 1-10). The northern part of the former MAAF, along Route 2A/Fitchburg Road, was used for the maintenance and storage of parachutes and former fueling systems were in this area (Figure 1-11).

AOC 50 was originally identified for investigation due to the presence of two World War II vintage fueling systems (Fueling Systems A and B). Environmental investigation commenced in 1992 with the completion of a SI (HLA, 2000a). This was followed by removal of the fueling systems (including two USTs), a SSI, and installation and operation of a soil vapor extraction (SVE) system to address tetrachloroethylene (PCE) contamination discovered near the Former Fueling System B. Based on results of these investigations, a Phase III SI was conducted, and finally, after being renamed an AOC, a RI was initiated in 1996 and the final RI report was issued in 2000 (HLA, 2000a). The primary contaminants addressed by the RI were PCE and related chlorinated compounds. However, during the course of the RI, low levels of fuel-related compounds (e.g., BTEX) were observed and evaluated in a separate report scheduled for simultaneous release (HLA, 2000a).

The AOC 50 Source Area was used for the storage and maintenance of parachutes from the early 1970s to closure of the installation in 1996. The buildings in the AOC 50 Source Area include Buildings 3803 (the former parachute shop, used primarily as a storage and maintenance facility), 3840 (the former parachute shakeout tower), 3824 (a gazebo), and 3801 (the former 10th Special Forces airplane parachute simulation building). A drywell associated with the floor and roof drains in Building 3840 and sinks located in Building 3803 was identified. PCE was used to spot-clean parachutes and may have entered sinks at Building 3803. Also, a PCE drum-storage area was located adjacent to Building 3801, later named the Former Drum Storage Area (FDSA). The investigations indicated PCE was used in small amounts and that waste PCE evaporated or was disposed of at AOC 50 Source Area. Both the former dry well area (FDW) and the FDSA were subjects of removal actions; however, groundwater contamination with chlorinated compounds (primarily PCE) was identified. Initially, the PCE plume was identified as three portions, the Source Area plume, a North Plume (extended north of the Source Area), and a Southwest Plume,

which extends from the Source Area approximately 3,000 feet downgradient towards the Nashua River (HLA, 2000a).

During the RI, another area of chlorinated solvent use and disposal was identified at AOC 50. A wash pit, located near Building 3807, reportedly was used by Army personnel to clean aircraft parts. An unspecified amount of PD-680, methyl ethyl ketone, and toluene were reportedly used and disposed of at the concrete lined wash pit. Waste cleaning solvent was reportedly passed through an oil/water separator. Interviewees were unable to recall the final disposition of the waste solvent or the year the wash pit was constructed (HLA, 2000a).

As documented in the ROD, the selected remedy for AOC 50 was SVE, enhanced reductive dechlorination (ERD) (with solubilized inorganic controls), In-Well Striping (IWS)/Aerobic Bioremediation, Monitoring, and Institutional Controls. In addition, Geochemical additives and In-situ Chemical Oxidation were included as contingencies to address inorganics and volatile organic compounds (VOCs), respectively, in the event that monitoring data indicate that implementation of these contingencies was warranted (ARCADIS, 2004).

In September 2004, a full-scale remedial action at AOC 50 was implemented that included SVE in the source area, ERD throughout the plume, and an IWS system at the western edge of the plume. The first ERD injection event was conducted in October 2004. The SVE system was discontinued in November 2005, as the monitoring program indicated that the recoverable mass of chlorinated VOCs (CVOCs) was removed from the vadose zone. The IWS was shut off in March 2013 once it was determined that it was not needed to treat dissolved arsenic or to “polish” the residual CVOC plume (Sovereign, 2013a). Semi-annual ERD injections continued through 2014. Annual ERD injections were completed in 2015 and 2017 (KGS, 2018a). Groundwater monitoring has been conducted since the start of the remedy. Through treatment in the source area and natural attenuation, CVOC concentrations in the North Plume have decreased below the cleanup criterion. The Source Area and Southwest Plume have decreased in size and in concentration through treatment and natural attenuation.

The Army currently leases the areas designated as the Source Area to MassDevelopment. The Source Area buildings are included in the lease but are abandoned. The Army, MassDevelopment, and the USFWS own portions of the area overlying the Southwest Plume, including the majority of the former airfield. The former airfield is closed to aircraft traffic and is currently leased by the Massachusetts State Police for training and vehicle storage.

The Merrimack Warehouse Realty Co., Inc. owns the area overlying the area formerly known as the North Plume. The property is zoned commercial and is developed with a building used for the manufacture of windshield washer fluid and as a storage facility. A fire pond is located on the property and would be used for fire suppression source water in the event of a fire.

The former MAAF was included in the PFAS PA (KGS, 2017c). Due to the age of the fuel systems (discontinued after the late 1940s), AFFF was not used for fire suppression. Historical records were reviewed for aircraft fires or crashes, fire suppression systems, storage of fire apparatus, and fire training procedures. Interviews were conducted with Devens Fire Chief LeBlanc and former Devens Fire Chief Broderick. Both Fire Chiefs could not specifically recall aircraft crashes or fires at the former MAAF. However, Chief LeBlanc acknowledged that when aircraft were reported to be using the airfield during an emergency, the fire trucks would respond and foam portions of the runway during aircraft landing. Historical review of aircraft landing and takeoff procedures indicated the use of fire apparatus being staged near the runway. Interviews conducted

with Fire Chief LeBlanc confirmed this procedure; however, he could not specifically recall an incident when the runway was foamed. Both Fire Chiefs indicated the main airfield runway may have been foamed during firefighting and crash training. Both Fire Chief LeBlanc and former Fire Chief Broderick noted that “training foam” was primarily used, due to the expense of AFFF; however, neither could verify how often training foam was used compared to AFFF (KGS, 2017c).

Historical documents did not indicate the presence of a fire suppression system containing foam in the hangar area (Buildings 3813 and 3818). No foam storage tanks were identified in historical documentation. Interviews conducted with the former and current Devens Fire Chiefs indicated that no foam fire suppression system were present. The former airfield hangar was not identified as potential release area; however, PFAS may have been stored at the former airfield hangar area during the operational period of the Fort Devens airfield (KGS, 2017c).

The former MAAF Fire Station was located in former Building T-3806 (Figure 1-11). Interviews conducted with the Devens Fire Chief indicated firefighting foam concentrate was stored in 5-gallon pails on the fire apparatus. Foam concentrate was stored in 55-gallon drums at the drum storage area (AOC 30) (Figure 1-5). The former fire station was not identified as potential release area; however, PFAS may have been stored at the former airfield hangar area during the operational period of the Fort Devens airfield (KGS, 2017c).

1.2.9 AOC 57 Building 3713 Fuel Oil Spill Site

AOC 57 is located between Barnum Road and Cold Spring Brook (Figures 1-2 and 1-12). The portion of Devens that includes AOC 57 was used primarily as a storage and maintenance area for military vehicles. AOC 57 consists of three sub-areas (Area 1, Area 2, and Area 3) that are located south to southeast of Building 3713 and former Buildings 3756, 3757, and 3758 (Figure 1-13).

Area 1 is a storm water drain that collects rainfall from the paved areas around Building 3713. The runoff from the storm drain flows to the outfall at Area 1, and eventually into Cold Spring Brook (HLA, 2000b) (Figure 1-14). Area 2 is located 800 feet northeast of Area 1, and adjacent to a vehicle storage yard associated with the former motor repair shops located in former Building 3757 and 3758 (Figure 1-15). The nearby former Building 3756 served as a mess hall and was later converted to a general storehouse. This area formerly consisted of an eroded drainage ditch created by periodic rain runoff. Area 3 is located approximately 600 feet to the northeast of Area 2, south of former vehicle maintenance motor pools and north of the Cold Spring Brook floodplain (Figure 1-16). The site is characterized by a historical garage and vehicle waste disposal area (HLA, 2000b). Area 3 was identified after test pits excavated east of Area 2 where historical photographs indicated soil staining showed the presence of TPH and CVOCs in 1995 (Harding, 2001).

In 1977, an estimated 50 to 100-gallon spill of No. 4 fuel oil was discharged through the Area 1 outfall (Harding, 2001). The fuel oil spill occurred from an overfilled UST at Building 3713 into a nearby storm drain (HLA, 2000b). Approximately 3,000 gallons of mixed soil and water were recovered through use of containment dikes and absorbent booms set up across Cold Spring Brook adjacent to Area 2 in 1977 (Harding, 2001).

In September 1992, an investigation was performed at Area 1 and 2 to determine the presence or absence of environmental contamination at AOC 57 resulting from the 1977 fuel oil spill. Polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbon content (TPHC), possibly associated with fuel oil, were detected at Area 1; however, a preliminary risk evaluation

indicated that there was no unacceptable risk for presumed commercial/industrial site reuse (HLA, 2000b). At Area 2, naphthalene and TPHC were detected in surface soils, and fingerprint analysis of soil indicated contaminated soil was most likely derived from lubricating oil, possibly from the release of vehicle crank case oil and not likely related to the No. 4 fuel oil release.

In 1994, a soil removal action was conducted at Area 2 in response to newly promulgated MCP standards (Harding, 2001) (Figure 1-15). During the removal action, it was discovered that the soil and groundwater contamination were more widespread than expected, the soil removal was stopped after 1,300 cubic yards of soil were excavated, and AOC 57 Area 2 was administratively transferred to the RI/FS process. Following the soil removal action, the area was regraded and a stone drainage swale was installed that discharges into Cold Spring Brook (HLA, 2000b).

In 1997, excavation of Area 1 outfall soil was conducted to address soil contamination resulting from releases of petroleum oil in response to newly promulgated MCP standards (HLA, 2000b). The time-critical removal action included excavation of a 22-foot by 22.5-foot area to a maximum depth of 3 feet bgs at the outfall location, approximately 25 cubic yards of contaminated soil were removed (Harding, 2001 ROD).

In the spring of 1999, a total of 1,860 cubic yards of soil was removed from Area 3 focusing on PCBs and extractable petroleum hydrocarbons (EPH) (HLA, 2000b) (Figure 1-16). In June 2000, the Army completed an RI at AOC 57 Areas 2 and 3 that revealed the presence of residual contamination at both sites (HLA, 2000b). The ROD selected no further action for Area 1, Excavation (For Possible Future Use) and land use controls (LUC) for Area 2, and Excavation (To Accelerate Groundwater Cleanup) and LUCs for Area 3 (Harding, 2001). The remedies for Area 2 and 3 also included long-term monitoring of groundwater and surface water.

The soil excavations in Area 2 and 3 were initiated in January 2002 and completed in February 2003 (H&S, 2015). At Area 2, the contamination extended beyond the assumed limits and petroleum waste seeped into the excavation. A petroleum product recovery system was operated while additional sampling was conducted. In 2003, the remaining contaminated soil was removed. A total of 4,361 tons of contaminated material were excavated from Area 2 (H&S, 2015). At Area 3, the excavation was completed to the target limits and the planned volume of soil was removed within these limits to depths ranging between 2 and 4 feet resulting in the removal of 197 tons of soil. The confirmatory samples met the ROD cleanup criterion and the area was backfilled (H&S, 2015).

Data obtained and observations made at Area 2 between 2002 and 2003 (during the soil excavation activities and subsequent investigations) prompted the submittal of an ESD in March 2004. The ESD expanded the Area 2 LTM activities to include EPH C₁₁-C₂₂ aromatics and PCB Aroclors (BRAC, 2004).

Evergreen Solar constructed a manufacturing facility between Areas 2 and 3 and Barnum Road (112 Barnum Road) in 2008/2009 to manufacture of silicon wafers used in solar power systems. The building was constructed with oversized/complex air handling and humidification, air and process cooling, power supply and distribution, compressed air production and distribution, specialty gas distribution, and waste water and hazardous material treatment systems. Evergreen Solar went bankrupt in 2011 and the property was sold to Calare Properties/Hackman Capital Properties. In 2012, Calare leased half the facility to Saint-Gobain Ceramics & Plastics. Saint-Gobain upgraded the facility for the manufacture of components used in LED lights (using sapphire substrates in LED bulbs for backlighting smartphones, tablets, etc.). In 2013, Calare

leased the other half of the building to Nypro Healthcare. In 2014, Nypro started its manufacturing of precision plastic products for customers in the healthcare, packaging, and consumer electronics industries (e.g., medical device manufacturing). In August 2014, Saint-Gobain ceased operations and Nypro moved into their space. In May 2015, Calare sold the property to an LLC/institutional buyer. The building is currently occupied by Nypro.

The property at former Building 3713 is currently U.S. Army. Building 3713 was demolished and another building was constructed on the property between 2008 and 2010.

1.2.10 AOC 74 Barnum Road Firefighting Exercise Site

The Barnum Road Firefighting Exercise Site (Figures 1-2 and 1-12) was first identified for investigation based on interviews conducted as part of the PA. No previous environmental investigations were found during historical document review (KGS, 2017c). The site was identified as SA 74 as part of the PFAS PA.

Former Building 3773 was used as an administrative building as part of the Army Reserve Center and former Building 3774 was used as storage (Figure 1-13). Firefighting equipment was stored at this location during the closure of the former MAAF (KGS, 2017c). Past firefighting training exercises with firefighting foam are believed to have been conducted behind former Building 3773 (BERS-Weston, 2018a).

The former Building 3773 was modified between 2001 and 2003. Most recently the property, 78 Barnum Road, was occupied by Nashoba Publishing and is currently unoccupied.

1.2.11 AOC 75 Former Building T-1445 Warehouse Fire

AOC 75 was first identified for investigation based on interviews conducted as part of the Devens PFAS PA. No previous environmental investigations were found during historical document review (KGS, 2017c). The site was identified as SA 75 as part of the PFAS PA.

AOC 75 is located off Saratoga Street (Figures 1-2 and 1-12). Building T-1445 (Figure 1-13) was reportedly used for storage of lumber and pipe (Arthur D Little, Inc., 1994). A large warehouse fire occurred at former Building T-1445 sometime during the late 1980s/early 1990s. Reportedly, due to the storage of flammable substances, the nature of the fire, and for purposes of firefighter safety, any available firefighting foam at that time was used to suppress the fire. Remnants from the fire were transported to and disposed of at AOC 5 and AOC 50 (BERS-Weston, 2018a).

The property at 18 Saratoga Street was constructed at the property between 2001 and 2003. Currently the building is occupied by Waiteco Machine Inc., which is a manufacturer and assembler of machined components.

1.2.12 AOC 76 Devens Fire Station

The Devens Fire Station is located at 182 Jackson Road at the intersection of Jackson Road and Barnum Road (Figures 1-2 and 1-17). There is a storm water retention pond located to the northeast of the Devens Fire Station building. Willow Brook is located east of the fire station.

The initial environmental investigation at the Devens Fire Station, designated as SA 76 at the time, was the PFAS PA (KGS, 2017c). The fire station at Jackson Road began operation in the 1940s by the Army for Fort Devens. No records have been found to document the potential storage/uses by the Army in this area before 1996 (KGS, 2017c). The fire station was transitioned to

MassDevelopment following base closure in 1996. The identified firefighting foam storage/use at the fire station post-dates the 1996 base closure (i.e., non-Army operations), although the Devens Deputy Fire Chief recalled that a dumpster fire at the fire station in the early 1990s was extinguished using foam. The Deputy Fire Chief indicated that, since 1996, the Devens Fire Department has conducted some training in the paved area behind the fire station where firefighting foams were discharged to the ground. During training events, firefighting foams were sprayed over the paved area behind (southeast of) the fire station (KGS, 2017c).

The Fire Chief has indicated that the Devens Fire Department currently stores small quantities of AFFF at the Jackson Road fire station. Engine #3 has a 30-gallon holding tank of AFFF; Engine #5 carries four 5-gallon pails; and 22 5-gallon pails are stored at the warehouse on Cook Street. When needed, the AFFF is connected to a truck sprayer and mixed with water at the point of use. There is no mixed foam stored on the truck or at the Devens Fire Station. The AFFF used since 1996 is “Universal Gold” manufactured by National Foam. The “Universal Gold” material safety data sheet indicates that the product contains a proprietary “fluoroalkyl surfactant” (KGS, 2017c).

Based on results of the PA, the fire station was included in the PFAS SI to determine whether the past use, storage, or disposal of firefighting foams at the fire station resulted in residual PFAS contamination at the site (KGS, 2017b). The designation of SA 76 was changed to AOC when this site was included in this RI.

1.2.13 Grove Pond Wellfield

The Town of Ayer operates a wellfield on the south shore of Grove Pond as part of the town municipal water supply (Figures 1-2 and 1-12). There are five supply wells on the south shore of Grove Pond. The Town of Ayer was operating Wells 6, 7, and 8 (Figure 1-12 and 1-18) in September 2016 and the combined flow from the wells is treated at a facility to reduce concentrations of metals. The Town of Ayer first sampled the supply wells and the combined flow after treatment in September 2016. The results indicated PFAS was present in the flow from all three wells with the highest concentrations from Well 8. The sum of the PFOS and PFOA concentrations from Well 8 exceeded the LHA. The supply wells and the combined flow after treatment were sampled on a quarterly basis since September 2016.

On February 26, 2018, the Town of Ayer discontinued use of Well 8 as a water supply well after MassDEP informed them that MassDEP is considering adopting recommendations addressing five PFAS chemicals [PFOS, PFOA, perfluoronanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), and perfluoroheptanoic acid (PFHpA)] at a sum of 70 ng/L. Well 8 continues to be pumped at a reduced rate of 150 to 200 gpm and the water is discharged to Grove Pond rather than contributing to the town drinking water supply. The Town of Ayer supplemented the water supply by reinitiating use of Well 1 (Town of Ayer, 2018).

The Massachusetts wellhead protection Zone I and IIs from the public water supplies in the vicinity of Devens are shown on Figure 1-18.

1.2.14 MacPherson Water Supply Well

MassDevelopment operates the MacPherson water supply well (located in the former North Post) (Figures 1-2 and 1-18) as part of the Devens municipal water supply. MassDevelopment first sampled the MacPherson well for PFAS in July 2016. MassDevelopment has continued to sample the well on a quarterly basis until February 2018 when the well was taken out of service after

MassDEP informed MassDevelopment that MassDEP is considering adopting recommendations addressing five PFAS chemicals (PFOS, PFOA, PFNA, PFHxS, and PFHpA) at a sum of 70 ng/L.

1.3 Previous PFAS Investigations at Devens

A PA for PFAS at Devens was conducted in 2016 (KGS, 2017c), a SI was conducted in 2017 (BERS-Weston, 2018a), and an SI addendum was conducted in 2018 (BERS-Weston, 2018b). In addition, a number of samples were collected from existing monitoring wells and a surface water monitoring location for PFAS analysis at the request of USEPA in December 2017/January 2018, which are presented in a report (KGS, 2018b) summarized in the SI Addendum (BERS-Weston, 2018b). These investigations are discussed below.

1.3.1 Preliminary Assessment

A base-wide PA was performed in 2016 to determine if a release of PFAS had occurred at Devens. The PA was conducted based on past operations at Devens and in response to USEPA health advisories, updated in May 2016, for PFOA and PFOS (USEPA, 2016a and b), which are two of the most prevalent PFAS typically detected in the environment. The evaluation of the potential PFAS sources at Devens was conducted utilizing all available documents, interviews with both current and former Devens workers, available sampling data, and findings from environmental database searches. Results of the base-wide evaluation determined that potential sources of PFAS were limited to areas of the former North Post, South Post, and Main Post sites in which AFFF potentially containing PFOS and PFOA, may have been used, stored, or disposed of.

Sites initially identified for the base-wide evaluation were the AOC 50 and SAs 30 and 31 located at the former MAAF in the former North Post; the former ranges AOCs 25, 26, 27, and 28, and former Training Area 6D (AOC 46) in the former South Post; and Building 2680 (SA 54) and the DRMO yard (AOC 32) in the former Main Post. SA 54 was eliminated from further evaluation in the PA due to known remedial activities conducted and the known operational period of the area as a gas station. During interviews conducted for the PA with knowledgeable personnel, two new SAs were identified in the former Main Post. The former Building 1445 where a fire was extinguished (SA 74) and an area along Barnum Road where the storage and training using firefighting foams occurred (SA 75).

The base-wide evaluation was further expanded per request of the USEPA to include SHL (AOCs 4, 5, and 18) in the former Main Post, the Devens WWTP (SA 19, 20, and 21) in the former North Post, and the Devens Fire Station on Jackson Road (later designated AOC 76) in the former Main Post. Figure 1-2 presents the locations of the sites included in the PA. Findings of the evaluation identified both potential Army and post-closure (non-Army) PFAS sources from AFFF.

Evaluations of the former South Post sites found no documented history of the use, storage or disposal of AFFF at AOCs 25, 26, 27, 28, and 46. Additionally, PFAS concentrations were non-detect in samples collected from water supply wells in the former South Post in 2016. The PA concluded that no additional investigation is warranted for these South Post sites.

Evaluations of former North Post sites indicated historical Army use of AFFF at AOC 50, SAs 30 and 31, and potential impact to the WWTP and SA 20 and SA 21 due to historical operations. Historical operations at SA 30 included potential storage of AFFF, at SA 31 included use of AFFF for firefighting training, and at AOC 50 included potential storage of AFFF by the former airfield hangar area and the potential application of AFFF to the main airfield runway during firefighting

and crash training. SA 20 and 21 were identified as a potential Army PFAS source due to the potential past disposal of AFFF compounds via the municipal sewer system and the WWTP was not designed to remove PFAS. Furthermore, results of sampling conducted in 2016 at the MacPherson water supply well detected concentrations of PFAS below the LHA. Potential PFAS source areas associated with post-closure (non-Army) operations include the WWTP from ongoing operations which include receiving ongoing wastewaters from the various sites at Devens. The PA concluded that a SI was warranted to determine if additional action is required at these former North Post sites.

Evaluation of former Main Post sites found no historical documentation that indicated the use, storage or disposal of AFFF at SA 74, SA 75, AOC 32, and AOC 5. However, interviews conducted with personnel knowledgeable about these sites indicated historical use of AFFF by the Army at SAs 74 (AFFF used during firefighting training behind the building) and 75 (AFFF used to extinguish a warehouse fire). AOC 32 was selected for further investigation as part of the SI, per request of the USEPA, due to concerns from historical storage of various materials at the site. AOC 5 was selected for further investigation as part of the SI because it is a location of municipal waste disposal during the operational period of Fort Devens and it may have received materials containing PFAS. SHL was included in the SI due to its historical use as a municipal landfill.

The PA also additionally identified the Army's use of AFFF at the Devens Fire Station (SA 76). Potential PFAS source areas associated with post-closure (non-Army) operations include the Devens Fire Station on Jackson Road (SA 76) where AFFF storage and training occurred and a fire response at the Devens Recycling Center (45 Independence Drive) in 2015 where AFFF was used. The PA concluded that a SI was warranted to determine if further investigation action is required at these Main Post sites.

1.3.2 Site Inspection

In 2017, the Army conducted a SI to determine the presence or absence of PFAS in soil, groundwater, and/or sediment and surface water at selected SAs and AOCs at Devens. The SAs and AOCs were previously identified in the PA as sites where AFFF containing PFAS may have been used, stored, or released and further investigation was warranted.

The following SAs and AOCs were included in the SI:

- AOC 5 Shepley's Hill Landfill,
- SA 20 Waste Water Treatment Plant Sand Filter Beds,
- SA 21 Waste Water Treatment Plant Sludge Drying Beds,
- SA 30 Former MAAF Drum Storage Area,
- SA 31 Former MAAF Fire Training Area,
- AOC 50 Former MAAF,
- SA 74 Barnum Road Firefighting Exercise Site; and,
- SA 75 Former Building, T-144 Warehouse Fire.

Activities performed as part of the SI included site reconnaissance; evaluation of water supply wells closest to the AOCs and SAs; survey of SI sample locations; collection of groundwater

samples from select preexisting wells; collection of soil and groundwater samples from temporary sample points; and collection of surface water and sediment samples from select locations at AOC 50.

A total of thirty-six grab groundwater samples were collected from existing groundwater monitoring wells at AOCs 5 and 32, and SAs 20, 21, 31, and 75. A total of forty-two grab groundwater samples were collected from temporary points located at AOC 50 and SAs 20, 21, 30, 31, 74, and 75. Using a Geoprobe® direct push technology, the temporary well points were advanced until positioned at the water table of the surficial aquifer, except at one location AOC 50, where the water table was one foot below the ground surface and a borehole was created with a hand auger.

A total of thirty-seven composite soil samples were collected from temporary points located at AOC 50 and SAs 20, 21, 30, 31, 74, and 75. Soil samples were taken at the borings for the temporary points and were advanced from 0 to 5 feet below ground surface (bgs), except at SA 31 (four samples were collected from the earthen berm at 12 to 14 inches bgs) and SA 20 (the sample collected from a WWTP sand filter bed was collected from 0 to 2 ft bgs). Six surface water samples were collected from storm water outfall locations that received runoff from the airfield at AOC 50. Additionally, two sediment samples were collected at AOC 50: one from the end of a breached drainage swale that received runoff from one of airfield outfalls; and one sample collected 130 ft downstream of the breached drainage swale. The samples were analyzed by modified Method 537 for PFAS. The results are presented on figures in Section 3.3.

At AOC 5, samples were collected from selected groundwater monitoring wells and both extraction wells to assess potential PFAS impacts to groundwater from waste in the landfill. PFAS concentrations above the LHA were detected at 2 of the 21 locations sampled, with a maximum sum of PFOS and PFOA concentrations of 98 ng/L (BERS-Weston, 2018a). The results from the extraction wells were below the LHA.

At SAs 20 and 21, samples were collected from three soil and six groundwater locations (three from existing monitoring wells and three from temporary well points). SA 20 groundwater sample locations were located downgradient of the sand infiltration beds and SA 21 groundwater sample locations were located within the former sludge drying beds. Soil sample locations were from the shallow zone (0 to 5 ft bgs) downgradient of SAs 20 and 21. Samples were also collected from the WWTP influent and effluent. Groundwater concentrations of both PFOS and PFOA exceeded the LHA of 70 ng/L at six locations, with a maximum sum of PFOS and PFOA concentrations of 320 ng/L. PFAS compounds were detected in the influent and effluent samples from the WWTP but the concentrations did not exceed the LHA. PFAS was also detected in the soil samples collected from SAs 20 and 21.

At AOC 30, soil and groundwater sampling were conducted at six locations within and downgradient of the former drum storage area. Since no existing monitoring wells existed in this area, groundwater samples were collected from temporary well points co-located with the soil boring sample locations. Groundwater concentrations of both PFOS and PFOA exceeded the LHA of 70 ng/L at five locations, with a maximum sum of PFOS and PFOA concentrations of 429 ng/L. PFAS was also detected in the soil samples collected from SA 30.

At AOC 31, soil was collected from five locations and groundwater profile samples were collected from four locations with and downgradient of the former firefighting training area. In addition, two existing monitoring wells associated with the former MAAF were sampled. Groundwater

concentrations of PFOS and PFOA exceeded the LHA of 70 ng/L at six locations, with a maximum sum of PFOS and PFOA concentrations of 39,000 ng/L. PFAS was also detected in the soil samples collected from SA 31.

At AOCs 32/43A, groundwater samples were collected from seven select groundwater monitoring wells located at AOC 32 and adjacent AOC 43A to assess potential PFAS impacts to the site. Groundwater concentrations slightly exceeded the LHA of 70 ng/L at one location, with a sum of PFOS and PFOA concentrations of 71 ng/L.

At AOC 50, soil and groundwater samples were collected in areas where former PFAS storage or use were suspected (i.e., former fire station area and runways/taxiways where firefighting foams may have been deployed) and at storm water outfalls that may have directed PFAS-impacted surface runoff to areas adjacent to the former airfield. Surface water and sediment sample locations were selected at the terminus of a former storm water outfall where PFAS-impacted surface water may have been formerly directed. Of 18 groundwater samples collected from temporary points at AOC 50, eight samples had PFAS concentrations exceeding the LHA, with a maximum sum of PFOS and PFOA concentrations of 2,111 ng/L near the former airfield hangar. PFAS was also detected in soil samples. PFAS was detected in surface water and sediment in two samples collected at the terminus of a former storm water outfall.

At SA 74, soil samples were collected from three locations and groundwater samples were collected from five locations. Groundwater concentrations of both PFOS and PFOA exceeded the LHA of 70 ng/L at two locations, with a maximum sum of PFOS and PFOA concentrations of 490 ng/L. PFAS was also detected in the soil samples collected from SA 74.

At SA 75, soil samples were collected from three locations and groundwater samples were collected from four locations. Groundwater concentrations of both PFOS and PFOA did not exceed the LHA of 70 ng/L, with a maximum sum of PFOS and PFOA concentrations of 67 ng/L. PFAS was also detected in the soil samples collected from SA 75.

The results confirmed the presence of PFAS at each of the AOCs and SAs included in the SI (AOCs 5, 32 and 50, and SAs 20, 21, 30, 31, 74, and 75). Based on the results, the SI recommended that a RI be conducted to at each of the AOCs and SAs. In addition, the SI also recommended that the RI should determine/evaluate the source and extent of PFAS impacting/ contamination of the Grove Pond wellfield and the Macpherson water supply well.

1.3.3 Site Inspection Addendum

During review of the PA, USEPA requested that the Army assess the Devens Fire Station, located at 182 Jackson Road, as a Potential Source Area in the PA and issue an addendum to the SI WP to specify the collection of soil and groundwater samples to evaluate the presence or absence of PFAS. A SI WP Addendum (KGS, 2017b) was prepared describing proposed work to assess the presence or absence of PFAS in soil and groundwater at the SA 76 Devens Fire Station.

As part of the SI Addendum, soil and groundwater samples were collected at nine locations. The sampling locations were selected to assess PFAS impacts at the Devens Fire Station. Groundwater concentrations of both PFOS and PFOA exceeded the LHA of 70 ng/L at six locations, with a maximum sum of PFOS and PFOA concentration of 4,160 ng/L. PFAS was also detected in the soil samples collected from SA 76 (BERS-Weston, 2018b). The results are presented on figures in Section 3.3.

The Devens Fire Station was subsequently classified as AOC 76. Recommendations from the SI Addendum for AOC 76 include conducting an RI to further delineate the nature and extent of contamination.

1.3.4 PFAS Sampling of Long-Term Monitoring Locations

During December 2017/January 2018, the Army conducted PFAS sampling at select AOCs (AOCs 5, 32/43A, 43G, 43J, 50, and 57) at the request of USEPA where LTM is currently performed. Samples were collected from 29 existing groundwater monitoring wells and once surface water location. Sampling locations included six wells at AOC 5, three wells at AOCs 32/43A, two wells at AOC 43G, four wells at AOC 43J, eight wells at AOC 50, four wells at AOC 57 Area 2, and two wells and a surface water location at AOC 57 Area 3.

Samples were analyzed for PFAS via isotope dilution. PFAS compounds were detected at each of the AOCs. The maximum combined PFOS and PFOA detections at each AOC were as follows:

- 72.9J ng/L (AOC 5),
- 72.1 ng/L (AOC 32/43A),
- 123 ng/L (AOC 43G),
- 11.1 ng/L (AOC 43J),
- 204 ng/L (AOC 50),
- 125.2 ng/L (AOC 57 Area 2), and
- 82 ng/L (AOC 57 Area 3) (KGS, 2018b).

The results are presented on figures in Section 3.3 with the results from the SI and SI Addendum to present a comprehensive understanding of PFAS at each site.

1.4 Remedial Investigation Work Plan Approach

The RI includes numerous AOCs. In order to expedite field activities, the AOCs were grouped into three areas. This section presents the AOCs and organization of the work plan components to allow for expeditious commencement of field work. Based on the results from the SI, the SI Addendum, and the sampling of LTM locations, the following AOCs were identified to be included in the RI due to detections of PFAS in soil or groundwater:

Areas of Contamination	Site Description
Former North Post	
AOC 20	Waste Water Treatment Plant Sand Filter Beds
AOC 21	Waste Water Treatment Plant Sludge Drying Beds
AOC 50	Former Moore Army Airfield
AOC 30	Former Moore Army Airfield Drum Storage
AOC 31	Former Moore Army Airfield Fire-Fighting Training Area

Former Main Post	
AOC 5	Shepley's Hill Landfill
AOC 32/43A	DRMO Yard/POL Storage Area
AOC 43J	Historical Gas Station J
AOC 43G	Historical Gas Station G
AOC 57	Building 3713 Fuel Oil Spill Site
AOC 74	Barnum Road Firefighting Exercise Site
AOC 75	Former Building T-1445 (Barnum Road location)
AOC 76	Devens Fire Station

In addition, the PFAS impacts to the Grove Pond wellfield and MacPherson water supply well will be investigated as part of the RI. If additional sources of PFAS contamination associated with Devens are identified during the investigation, those sources will also be investigated.

To expedite the field investigations, the identified AOCs, Grove Pond wellfield, and MacPherson water supply well areas were grouped into three areas.

Area 1 consists of:

- AOC 57 Building 3713 Fuel Oil Spill Site;
- AOC 74 Barnum Road Firefighting Exercise Site;
- AOC 75 Former Building T-1445 Warehouse Fire; and,
- Grove Pond wellfield.

Area 2 consists of:

- AOC 5 Shepley's Hill Landfill;
- AOC 32/43A Former Defense Reuse and Marketing Office/POL Storage Area;
- AOC 43G Historical Gas Station G;
- AOC 43J Historical Gas Station J;
- AOC 76 Devens Fire Station; and,
- MacPherson water supply well.

Area 3 consist of:

- AOC 50 former MAAF;
- AOC 30 former MAAF fire training area;
- AOC 31 former MAAF drum storage area;
- AOC 20 Waste Water Treatment Plant Sand Filter Beds; and,
- AOC 21 Waste Water Treatment Plant Sludge Drying Beds.

The RI WP including the Quality Assurance Project Plan (QAPP), and the HERA Work Plan Addendum are applicable to all three areas.

Three Area-Specific Field Sampling Plans (FSP) will be provided as addenda to the RI WP in a sequential manner. The FSP addenda provide the details regarding the proposed sampling program for each Area to include site-specific sampling design and rationale, and the sampling locations and methods. This approach will enable field investigations to begin within Area 1, while the FSPs for Areas 2 and 3 are being prepared. The three areas were designated for sequencing of field activities and do not represent prioritization of sites.

1.5 Regulatory Framework

The RI is being performed in accordance with the CERCLA of 1980, as amended by Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan requirements.

USEPA issued a LHA for drinking water of 70 nanograms per liter (ng/L) for the combined concentrations of PFOS and PFOA following toxicity studies (USEPA, 2016a, 2016b). In June 2018, MassDEP issued a public health guidance to address five PFAS chemicals, specifically PFOA, PFOS, PFNA, PFHxS, and PFHpA. The guideline, known as an Office of Research and Standards Guideline (ORSG), provides recommended contaminant levels in drinking water and is set to be protective against adverse health effects for all people consuming the water for a lifetime. The ORSG is the level of the five PFAS compounds (PFOA, PFOS, PFNA, PFHxS, and PFHpA), individually or in combination of 70 ng/L.

1.6 Document Organization

This RI WP is organized as follows:

- Section 1 – Introduction: Presents the project background, provides the site history, summarizes the previous investigations related to PFAS, describes the approach for and content of RI, and presents the regulatory approach.
- Section 2 – Objectives: Presents the overall objectives of the RI and principal study questions to be addressed by the RI.
- Section 3 – Conceptual Site Model: Summarizes the physical characteristics of the sites, describes the regional hydrogeology, presents the nature and extent of known PFAS contamination, describes land use and PFAS fate and transport, and presents the exposure assessment.
- Section 4 – Remedial Investigation Activities: Summarizes the planned RI activities and associated water supply well inventory.
- Section 5 – Deliverables: Identifies the deliverables that will be generated for the project.
- Section 6 – Project Schedule: Presents the RI WP schedule including the phased Area-specific FSP submittal and review cycles.
- Section 7 – References: Lists references.

This RI WP includes a Sampling and Analysis Plan (SAP) that consists of two plans: Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP). The QAPP is provided as

Appendix A to the RI WP. The QAPP describes the chemical data quality objectives, field data-gathering methods, analytical methods and measurements, Quality Assurance/Quality Control (QA/QC) protocols necessary to achieve the Data Quality Objectives (DQOs), and data assessment procedures for the evaluation and the identification of any data limitations.

Three Area-Specific FSPs will be provided as addenda to the RI WP, as indicated in Section 1.4.

A Human and Ecological Risk Assessment (HERA) Work Plan is provided as an Addendum to the RI WP. The HERA Work Plan presents the procedures that will be used to assess the level of risk to human health and the environment associated with known and anticipated exposures related to releases of site contaminants.

2.0 OBJECTIVES

The overall objectives of the RI are to:

- Define the nature and extent of PFAS in groundwater, soil, surface water, and sediment at or originating from former Fort Devens (“Devens”), including evaluations of potential continuing sources of PFAS contamination to those environmental media.
- Evaluate PFAS migration from Devens to the Grove Pond and Devens public water supply wells and determine whether other public or private water supply wells have been impacted by PFAS migrating from Devens.
- Update and refine the conceptual site model (CSM), including actual and potential exposure pathways.
- Conduct a quantitative HHRA and a qualitative ecological risk evaluation, which will be completed to estimate potential human health and ecological risks associated with exposure to PFAS in groundwater, soil, surface water, and sediment.
- Collect appropriate data to support a feasibility study under CERCLA.

The specific study questions developed for the RI objectives are:

- Are the PFAS detected at AOCs 5, 20, 21, 30, 31, 32/43, 43G, 43J, 50, 57, 74, 75, 76, or other sites originating from Devens impacting the Grove Pond water supply wells, MacPherson water supply wells, or other water supply wells?
- What is the predicted impact of AOCs to water supply wells over time?
- Do other sources of PFAS exist that may impact the Grove Pond and MacPherson supply wells?
- Are the PFAS detected in groundwater attributable to identified AOC source areas?
- Do the PFAS concentrations detected in groundwater pose an unacceptable risk to human health?
- Do the PFAS concentrations detected in soil and surface water bodies pose an unacceptable risk to human health and the environment?
- Do PFAS concentrations in soil represent a significant continuing source of PFAS that can impact groundwater at concentrations that pose an unacceptable human health risk?

The Data Quality Objectives for the RI are presented in QAPP Worksheet #11 (Appendix A) in accordance with the USEPA 7-step process (USEPA, 2006).

3.0 CONCEPTUAL SITE MODEL

3.1 Physical Characteristics

Devens is located in the towns of Ayer, Shirley, Harvard, and Lancaster, Massachusetts, approximately 35 miles northwest of Boston, Massachusetts. The installation occupied approximately 9,260 acres. Prior to base closure, Fort Devens was divided into the North Post, Main Post, and South Post. The area surrounding Devens is primarily comprised of rural residential properties. Portions of Devens have been redeveloped for commercial/industrial use.

Devens lies within the Nashua River basin. The Nashua River flows north through the former North, Main, and South Posts. The Nashua River forms the eastern installation boundary on the former South Post and much of the western boundary of the former Main Post. The Nashua River is just east of the MacPherson supply well and flows northward and past the east side of AOCs 20 and 21, and south and west of AOCs 30, 31, and 50. Other notable surface water features include: Plow Shop Pond located east of AOC 5 and Nonacoicus Brook located north of AOC 5, Grove Pond located north of the Grove Pond wellfield, Cold Spring Brook located east of AOCs 57 and 74, an unnamed stream located east of AOC 43G, Robbins Pond located east of AOC 43G, and Willow Brook that is located north and east of AOC 76 (Figure 3-1). The specific surface water bodies and their relations to specific areas of investigation are discussed in each Area-specific FPS.

The geography of Devens is characterized by undulating glacial terrain. The landforms are products of glacial erosion and deposition on a crystalline bedrock terrain. Terrain at Devens falls generally into three types. The least common is bedrock terrain, where rocks that have been resistant to both glacial and fluvial erosion remain as topographic highs, sometimes thinly veneered by glacial deposits. Shepley's Hill on the former Main Post is the most prominent example (HLA, 2000b). A more common terrain at Devens consists of tills deposited by glaciers. These landforms often conform to the shape of the underlying bedrock surface. They range from areas of comparatively low topographic relief to elongated hills (drumlins) (HLA, 2000b).

The most common terrain at Devens was formed by sediment accumulations in glacial-meltwater streams and lakes (glaciofluvial and glaciolacustrine deposits). Landforms include extensive flat uplands such as the area of the former MAAF and WWTP located on the former North Post. Other prominent glacial meltwater features are kame and kettle topography present on the former South Post and former Main Post near Mirror Lake and Little Mirror Lake.

The Nashua River forms the western boundary of much of the former Main Post, and there its valley is deep and comparatively steep-sided with extensive bedrock outcroppings on the eastern bank. The river flows through the former North Post in a well-defined channel within a broad forested floodplain (HLA, 2000b).

The major glacial units consist of till, deltaic deposits from former glacial Lake Nashua, and deposits from glacial meltwater streams. Glacial till at Devens consists of unstratified gravel to silt and typically contains boulders. The till at the site is typically approximately 10 feet thick but is up to 60 feet thick in the cores of drumlins. The glacial lake deposits consist chiefly of sand and gravelly sand. Lake bottom deposits consist of sand, silt, and clay. Post-glacial deposits consist of river terrace sands and gravels, fine alluvial sands and silts, as well as, peat and silt and sands in swampy areas.

Devens is underlain by low-grade metasedimentary rocks, gneisses, and granites. The bedrock units underlying Devens are: Worcester Formation (Carbonaceous slate and phyllite), Oakdale Formation (Metasiltstone and phyllite), Berwick Formation (thin- to thick-bedded metamorphosed calcareous sandstone, siltstone, and minor muscovite schist), Chelmsford Granite (light gray, even and medium-grained muscovite bearing granite), and Ayer Granite (biotite granite and granodiorite). Bedrock is typically unweathered to only slightly weathered at Devens (HLA, 2000b).

3.2 Regional Hydrogeology

The Nashua River is the eventual discharge locus for surface water and groundwater flow at Devens. The tributaries of the Nashua River at Devens are Nonacoicus Brook and Walker Brook on the former North Post; Cold Spring Brook (which is a tributary of the Nonacoicus Brook through Grove Pond and Plow Shop Pond) on the former Main Post. There is also a lesser stream, Willow Brook that discharges to Nonacoicus Brook to the north. Willow Brook originates from Robbins Pond and is fed by Robbins Pond, surface water runoff, storm water discharge, and groundwater (Figure 3-1). The groundwater flow direction at each AOC is addressed in each Area-specific FSP Addendum.

Glacial meltwater deposits constitute the primary overburden aquifer at Devens. Groundwater also occurs in the underlying bedrock; however, flow is limited because regional bedrock lacks primary porosity and water moves only in fractures and dissolution voids.

The zones of highest transmissivity within the overburden are found in areas of thick glacial meltwater deposits on the former North and Main Posts at Devens, and these encompass deposits in which the Sheboken, Patton, MacPherson, and Grove Pond water supply wells are screened (Figure 3-2). Due to the high transmissivity of these overburden deposits, these areas are preferential groundwater flow areas. The zones of lowest transmissivity are typically associated with exposed till and bedrock.

Groundwater recharge occurs in upland areas and groundwater flows generally from the topographic highs to topographic lows. Groundwater discharges in wetlands, ponds, streams, and directly into the Nashua River.

Regional groundwater flow and information available regarding geology and hydrogeology in the Devens, MA area were reviewed to assess potential impacts from PFAS to water supply wells in the surrounding areas. There is concern regarding groundwater originating at Devens impacting wells located across hydraulic groundwater divides such as Cold Spring Brook and Bowers Brook in the town of Harvard, MA. Based on a review of site topography, overburden soil thickness, overburden soil characteristics, modeled groundwater flow contours, groundwater hydraulic gradients, and aquifer transmissivity, it is unlikely that potential PFAS impacts to these wells would be a result of groundwater originating from Devens.

In the town of Shirley, no PFAS impacts are expected at the supply wells 227000-03G and -4G (Patterson Road well and Walker Well) (Figure 1-18) and private water supply wells in the same area west of the former North Post. Groundwater from the former Fort Devens Main Post discharges to the Nashua River and water entering the Walker Road wells is originating from an area west of the former North Post. Groundwater in AOCs 20, 21, 30, 31, and 50 in the former North Post are flowing to the immediately-adjacent Nashua River, and are not flowing toward Patterson Road and Walker wells in Shirley, MA.

3.3 Summary of Existing PFAS Results

Groundwater, surface water, soil, and sediment at areas across Devens have been sampled for PFAS as part of the SI (BERS-Weston, 2018a), SI Addendum (BERS-Weston, 2018b), and a sampling event conducted in December 2017 and January 2018 requested by USEPA (KGS, 2018b). Select PFAS compounds from these sampling efforts are presented in Figures 3-3 through 3-16 and are discussed below.

Area 1

The PFOS and PFOA concentrations in groundwater and surface water from AOCs in Area 1 (Grove Pond wellfield, AOCs 57, 74, and 75) are shown on Figure 3-3. In Area 1, the maximum sum of PFOS and PFOA concentrations at:

- AOC 74 was 490 ng/L,
- AOC 57 Area 3 was 82 ng/L,
- AOC 57 Area 2 was 125.2 ng/L,
- AOC 75 was 67 ng/L, and
- the Grove Pond wellfield was 93 ng/L (Well 8, January 2018).

The Town of Ayer started sampling their water supply wells for PFAS in September 2016. The most recent PFAS sampling, April 2018, had a sum of PFOS and PFOA concentration of 11 ng/L in the blended water, 6 ng/L in Well 1, 5 ng/L in Well 6, and 16 ng/L in Well 7 (Table 3-1). Well 8 was last sampled in January 2018 and had a sum of PFOS and PFOA concentrations of 93 ng/L.

Groundwater at AOC 57 Area 1 has not been analyzed for PFAS. One surface water sample has been collected from Cold Spring Brook at AOC 57 Area 3. The PFOS and PFOA concentrations in soil in Area 1 (AOC 74 and AOC 75) are shown on Figure 3-4. No other soil samples or sediment samples collected from Area 1 have been analyzed for PFAS.

Area 2

The MacPherson well was first sampled for PFAS in July 2016 and has continued to be sampled on a quarterly basis until February 2018 when the well was taken out of service. The most recent PFAS sampling, February 2018, had a sum of PFOS and PFOA concentrations of 59 ng/L (Table 3-1).

The PFOS and PFOA concentrations in groundwater at AOC 5 are shown on Figure 3-5. In 2017 and 2018, 27 monitoring and extraction wells were sampled at AOC 5 for PFAS. Two locations had the sum of PFOS and PFOA concentrations above the LHA. The maximum sum of PFOS and PFOA concentrations was 98 ng/L. No other media have been sampled for PFAS at AOC 5.

The PFOS and PFOA concentrations in groundwater at AOCs 32/43A are shown on Figure 3-6. Groundwater samples were collected from ten monitoring wells. Groundwater concentrations of both PFOS and PFOA slightly exceeded the LHA at one location at a concentration 71 ng/L. No other media have been sampled for PFAS at AOCs 32/43A.

The PFOS and PFOA concentrations in groundwater at AOC 43G are shown on Figure 3-7. Groundwater samples were collected from two monitoring wells at AOC 43G in January 2018 per request of USEPA. Groundwater concentrations of both PFOS and PFOA exceeded the LHA at

both locations. The maximum sum of PFOS and PFOA detections was 123 ng/L. No other media have been sampled for PFAS at AOC 43G.

The PFOS and PFOA concentrations in groundwater at AOC 43J are shown on Figure 3-8. Groundwater samples were collected from four monitoring wells at AOC 43J in December 2017/January 2018 per request of USEPA. The detected concentration of PFOS and PFOA were below the LHA at all four locations. The maximum sum of PFOS and PFOA detections was 11.1 ng/L. No other media have been sampled for PFAS at AOC 43J.

The PFOS and PFOA concentrations in groundwater and soil at AOC 76 are shown on Figure 3-9. As part of the SI soil and groundwater samples were collected at nine locations within AOC 76. Since no existing monitoring wells existed in this area, groundwater samples were collected from temporary well points co-located with the soil boring sample locations. Groundwater concentrations of both PFOS and PFOA exceeded the LHA at six locations, with a maximum sum of PFOS and PFOA concentration of 4,160 ng/L. PFAS was also detected in the soil samples.

Area 3

The PFOS and PFOA concentrations in soil and groundwater at AOCs 20 and 21 are shown on Figure 3-10. As part of the SI, samples were collected from three soil and six groundwater locations (three from existing monitoring wells and three from temporary well points). Samples were also collected from the WWTP influent and effluent. Groundwater concentrations of both PFOS and PFOA exceeded the LHA at six locations, with a maximum sum of PFOS and PFOA concentration of 320 ng/L. PFAS compounds were detected in the influent and effluent samples from the WWTP but the concentrations did not exceed the LHA. PFAS was also detected in the soil samples.

The PFOS and PFOA concentrations in groundwater and soil at AOC 30 are shown on Figure 3-11. As part of the SI soil and groundwater sampling were conducted at six locations within and downgradient of the former drum storage area. Since no existing monitoring wells existed in this area, groundwater samples were collected from temporary well points co-located with the soil boring sample locations. Groundwater concentrations of both PFOS and PFOA exceeded the LHA at five locations, with a maximum sum of PFOS and PFOA concentration of 429 ng/L. PFAS was also detected in the soil samples.

The PFOS and PFOA concentrations in groundwater and soil at AOC 31 are shown on Figure 3-12. As part of the SI soil and/or groundwater sampling were conducted at eight locations within and downgradient of the former firefighting training area. Two existing monitoring wells associated with AOC 50 were also sampled. Groundwater samples were also collected from four temporary well points. Groundwater concentrations of both PFOS and PFOA exceeded the LHA at six locations, with a maximum sum of PFOS and PFOA concentration of 39,000 ng/L. PFAS was also detected in the soil samples. Figure 3-13 also shows PFAS results from nearby AOC 50 sampling.

The PFOS and PFOA concentrations in groundwater at AOC 50 are shown on Figures 3-13 and 3-14, concentrations in soil are shown on Figure 3-15, and concentrations in surface water and sediment are shown on Figure 3-16. Soil and groundwater samples were collected in areas where former PFAS storage or use were suspected (i.e. former fire station area and runways/taxiways where firefighting foams may have been deployed) and at storm water outfalls that may have directed PFAS-impacted surface runoff to areas adjacent to the former airfield. Surface water and

sediment sample locations were selected at the terminus of a former storm water outfall where PFAS-impacted surface water may have been formerly directed. Of the 26 locations sampled for groundwater, 15 locations had PFAS concentrations exceeding the LHA, with a maximum sum of PFOS and PFOA concentration of 2,111 ng/L near the former airfield hangar. PFAS was also detected in soil, surface water, and sediment samples collected from AOC 50.

3.4 Land Use

As part of the Fort Devens closure, portions of the property formerly occupied by Fort Devens were retained by the Army for reserve forces training (U.S. Army Garrison Fort Devens). Areas not retained as part of U.S. Army Garrison Fort Devens were transferred to new owners, MassDevelopment and the USFWS, for reuse and redevelopment. The areas and types of land use are summarized in the Devens Reuse Plan (Vanassee Hangen Brustlin, Inc., 1994). Current zoning outlines and designations (Figure 3-17) were provided by MassDevelopment.

The land in the vicinity of AOCs 20 and 21 is used for the Devens WWTP and is designated for use as Innovation & Technology Center and Open Space and Recreation.

Most of the land in the vicinity of AOCs 30, 31, and 50 is designated for use as Special Use, Open Space and Recreation, and a small portion of the property is still U.S. Army property. The land northeast of the AOC 50 Source Area, on the north side of Route 2A was not part of Devens is occupied by commercial/industrial properties. The Army currently leases the areas designated as the AOC 50 Source Area to MassDevelopment. The former airfield is closed to aircraft traffic and is currently leased by the Massachusetts State Police for training and vehicle storage. The state police also use two buildings near the runway in support of these activities. One of the buildings used by the State Police is the former MAAF fire station. Land between the airstrip and the Nashua River is wooded, and slopes steeply toward the Nashua River. A 150-foot buffer zone adjacent to the river has been transferred to the USFWS.

The land in the vicinity of AOC 32/43A is designated for reuse as Rail, Industrial, Trade-Related. AOC 32/43A were redeveloped to include paved areas and a large warehouse constructed in 2001 (Nobis, 2005). The current owner, O'Reilly Auto, purchased the property in 2013.

AOC 43G is located on Army property.

The land in the vicinity of AOC 57 was designated for reuse as Rail, Industrial, Trade-Related in the upland area, and as Open Space and Recreation in the wetlands. AOC 57 Area 1 is located in an undeveloped area directly adjacent to land designated for Open Space and Recreation. AOC 57 areas 2 and 3 are located at the edge of developed property (112 Barnum Road) and in land designated for Open Space and Recreation.

The land in the vicinity of AOC 74 was designated for reuse as Rail, Industrial, Trade-Related in the upland area, and as Open Space and Recreation in the wetlands. Most recently the property, 78 Barnum Road, was occupied by Nashoba Publishing and is currently unoccupied and for sale.

The land in the vicinity of AOC 75 is designated for reuse as Rail, Industrial, Trade-Related. The property at 18 Saratoga Street was developed and currently the building is occupied by Waiteco Machine Inc.

AOC 76 is the Devens Fire Station and is adjacent to land designated for Open Space and Recreation.

The land in the vicinity of AOC 43J is designated for use as Innovation & Technology Business.

3.5 PFAS Fate and Transport

The source of the PFAS detected at Devens is believed to be primarily associated with the release of AFFF during firefighting, firefighting-training, and potentially storage activities. Following the release of AFFF at or near the ground surface, the PFAS would have migrated vertically through the unsaturated vadose zone. Contamination may have initially sorbed to soil and then would have dissolved over time into infiltrating water from precipitation and ultimately reached groundwater. Once in groundwater the dissolved-phase contamination would migrate in the direction of groundwater flow. Groundwater contamination migrates downgradient from the source areas to surface water discharge areas or could be extracted via water supply wells (Figure 3-18).

PFOS and PFOA are less volatile than many other groundwater contaminants (ITRC, 2018). PFOS and PFOA are water soluble and PFOS and PFOA have Log K_{oc} values of 2.57 mL/g and 2.06 mL/g, respectively, and thus does not easily absorb to sediment or aquifer materials (USEPA 2016a and USEPA 2016b). PFOS and PFOA are stable in the environment and resistant to hydrolysis, photolysis, volatilization, and biodegradation. In water, no natural degradation has been demonstrated, and dissipation is by advection, dispersion, and sorption to particulate matter (USEPA, 2016a, USEPA, 2016b).

3.6 Exposure Assessment

PFAS have been detected in groundwater, soil, surface water, and sediment at Devens. There is a potential risk of exposure to PFAS contamination in these media. The current land uses at the PFAS AOCs at Devens consist of commercial and recreational uses. Currently, there are no identified residential properties that have been impacted by PFAS from Devens.

The human health exposure pathways are presented in Figure 3-19 and were used to identify specific media that would be sampled to support the human health risk assessment. Further details on the risk assessment are provided in the HERA Work Plan Addendum.

The principal threat under the groundwater exposure pathway is via private and/or public wells used to supply a source of drinking water. The current and future risk from exposure to municipal supply wells that have been impacted by PFAS originating from Devens will be assessed. This currently includes the Grove Pond water supply wells and MacPherson water supply well. There are no private residential wells allowed at Devens but potential future residential exposure to groundwater at Devens will be assessed. There are no currently identified private wells located outside of Devens impacted by PFAS migrating from Devens. The potential for migration of PFAS contaminated groundwater beyond Devens and potential impact to current or future private and/or public wells will be assessed. If a migration pathway from Devens to private or other public well is identified and PFAS is identified at the well, then the well will be included in the exposure assessment. An exposure assessment via consumption of agricultural products will not be conducted as lower PFAS concentrations in private or public water supply wells will result in a risk via a residential exposure.

Exposure to soil will be assessed for potential future residents, current and future commercial/industrial workers, current and future and construction workers, and current and future recreational users.

The surface water and/or sediment have been impacted by the discharge of PFAS impacted groundwater at some of the AOCs. Exposure to surface water and sediment will be assessed for current and future recreational exposure. The specific water bodies that will be sampled and assessed are presented in the Area-Specific FSP addenda.

Vapor and vapor intrusion are not included in the exposure assessment because PFAS are not volatile.

4.0 REMEDIAL INVESTIGATION ACTIVITIES

The investigation includes activities in support of the RI as well as a water supply well inventory for areas outside of the former Fort Devens.

4.1 Remedial Investigation

Specific activities planned to support the PFAS RI include reviewing previous investigation documents, collecting and analyzing data, and conducting a quantitative HHRA and a qualitative ecological risk assessment. The quantitative HHRA and qualitative ecological risk assessment are discussed in the HERA Work Plan Addendum to this RI WP.

Specific data collection and analysis activities were designed to address objectives specific to each AOC of the RI and are presented in the area-specific FSP Addenda. The FSP Addenda provide the details regarding the proposed sampling program for each AOC, including the sampling design and rationale, and the sampling locations and methodology.

4.2 Water Supply Well Inventory

An inventory of public and private water supply wells located near the former Fort Devens will be conducted as part of the overall RI activities. The inventory is being prepared as a proactive step to identify surrounding public and private water supply wells. The phased approach to performing the well inventory includes the following steps:

1. The individual property parcels within 1-mile of PFAS detections in Devens groundwater (Figure 4-1) will be identified using GIS applications and screened to exclude parcels located within a public water service area (MassGIS Data: Public Water Supply Service Territories).
2. The list developed from Step 1 will be further screened to exclude vacant (undeveloped) parcels using a statewide parcel dataset (e.g., MassGIS Standardized Assessors Parcels) and its associated metadata. Completion of Steps 1 and 2 will identify the list of property parcels that are developed but do not have a connection to a public water source, and therefore, are likely to have private wells.
3. The list developed from Steps 1 and 2 will be refined by a written letter request for (a) obtaining lists or GIS files of known private wells from each municipality (e.g., from the town Board of Health) and (b) obtaining public utility customer lists from each municipality (e.g., from the town Department of Public Works or Assessors office) to cross-reference municipal water accounts.
4. The Massachusetts Energy and Environmental Affairs data portal and the MassDEP WellSearch data portal will then be used as a resource to obtain more information about the identified wells, such as well driller reports and well identifications. Domestic well data will be extracted into a spreadsheet for each of the municipalities. The list of private wells will be matched to the property parcels using addresses, well survey coordinates, and any other identifying features. Once plotted onto maps using GIS, domestic wells that fall within the public water service areas will be removed as it is assumed that the town water is used as a drinking water supply and the listed domestic well is either inactive or used for non-drinking water purposes such as irrigation.

5. For any property parcels that were not able to have its water supply status identified by Steps 1-4, aerial photographs will be reviewed to determine whether the property is developed or not. Parcels that are developed and are not within the municipal water supply district will be assumed to have a private well.

4.3 Water Supply Well Sampling

The Army will sample selected community and private water supply wells within or near a 1-mile radius of prior detections of PFAS in groundwater at the Devens. Although there is currently no apparent hydrogeologic connection between the locations of known detections of PFAS in groundwater at Devens (Section 3.2) and the community and private wells selected for sampling, this work is proposed at the request of the USEPA as a precautionary measure. Thus, it should be noted that if PFAS are detected in any of the community or private wells, the source of the contamination may be attributable to sources other than Devens. The hydrogeology of the individual AOCs will be further evaluated during the RI to identify the extent of PFAS associated with the former Fort Devens.

5.0 DELIVERABLES

The RI activities, water supply well inventory, and water supply well sampling results will be documented in separate deliverables.

5.1 Remedial Investigation Data Packages

In an effort to expedite the delivery of RI results to stakeholders (i.e., in advance of the RI Report), interim deliverables (RI Data Packages) will be provided. The deliverables will consist of laboratory reports, tables of validated data, and preliminary figures showing results. Three interim deliverables will be prepared, one each for Area 1, Area 2, and Area 3, after the field work at each area is complete.

5.2 Remedial Investigation Report

The activities conducted in support of the RI, including the nature and extent evaluations, updated CSM, quantitative HHRA, and a qualitative ecological risk assessment, will be detailed in an RI Report along with the results, analysis of results, conclusions, and recommendations after completion of the field efforts at Areas 1, 2, and 3.

5.3 Water Supply Well Inventory

The results of water supply well inventory will be prepared in an interim deliverable separate from the RI. The deliverable for the well inventory will consist of a memorandum detailing the methodology used, with figures and tables summarizing the findings of the inventory. Tables will include well identification number, address, property parcel identification, well specifications (e.g., well type, depth), and well coordinates, as available. The well inventory will also be incorporated in the RI Report in an appropriate manner.

5.4 Water Supply Well Sampling

Water supply well sampling results will be tabulated and will be provided to the well owners, USEPA, and MassDEP within 60 days of the sampling event. Results will also be incorporated in the RI Report in an appropriate manner.

6.0 PROJECT SCHEDULE

The private well inventory commenced in May 2018 and is expected to be completed in July 2018. A schedule with major milestones for RI activities by Area is presented below. The schedule will be routinely updated as the Area-specific FSPs and scope of the field programs are finalized.

Area 1 – Grove Pond Water Supply Wells, AOC 57, AOC 74, and AOC 75

Milestone Activity	Date
Final FSP Addendum	August 2018
Start Field Program	September 2018
End Field Program	December 2018*
Submit RI Data Package	April 2019
Submit Draft RI Report	July 2019

Area 2 – MacPherson Well, AOC 5, AOC32/43A, AOC 43G, AOC 43J, and AOC 76

Milestone Activity	Date
Final FSP Addendum	September 2018
Start Field Program	October 2018
End Field Program	February 2019*
Submit RI Data Package	May 2019
Submit Draft RI Report	August 2019

Area 3 – AOC 20, AOC 21, AOC 30, AOC 31, and AOC 50

Milestone Activity	Date
Final FSP Addendum	October 2018
Start Field Program	November 2019
End Field Program	March 2019*
Submit RI Data Package	June 2019
Submit Draft RI Report	September 2019

* Winter weather may delay field work completion

RI Data Packages, one each for Area 1, Area 2, and Area 3, will be delivered to the stakeholders after completion of field work, laboratory analyses, and data validation. The RI Data Packages will rely primarily on tables and figures to present the results of the investigations. A quantitative HHRA and a qualitative ecological risk assessment will be conducted, and a RI Report will be prepared and submitted for each Area, if appropriate based on contamination distribution and receptors at the AOCs.

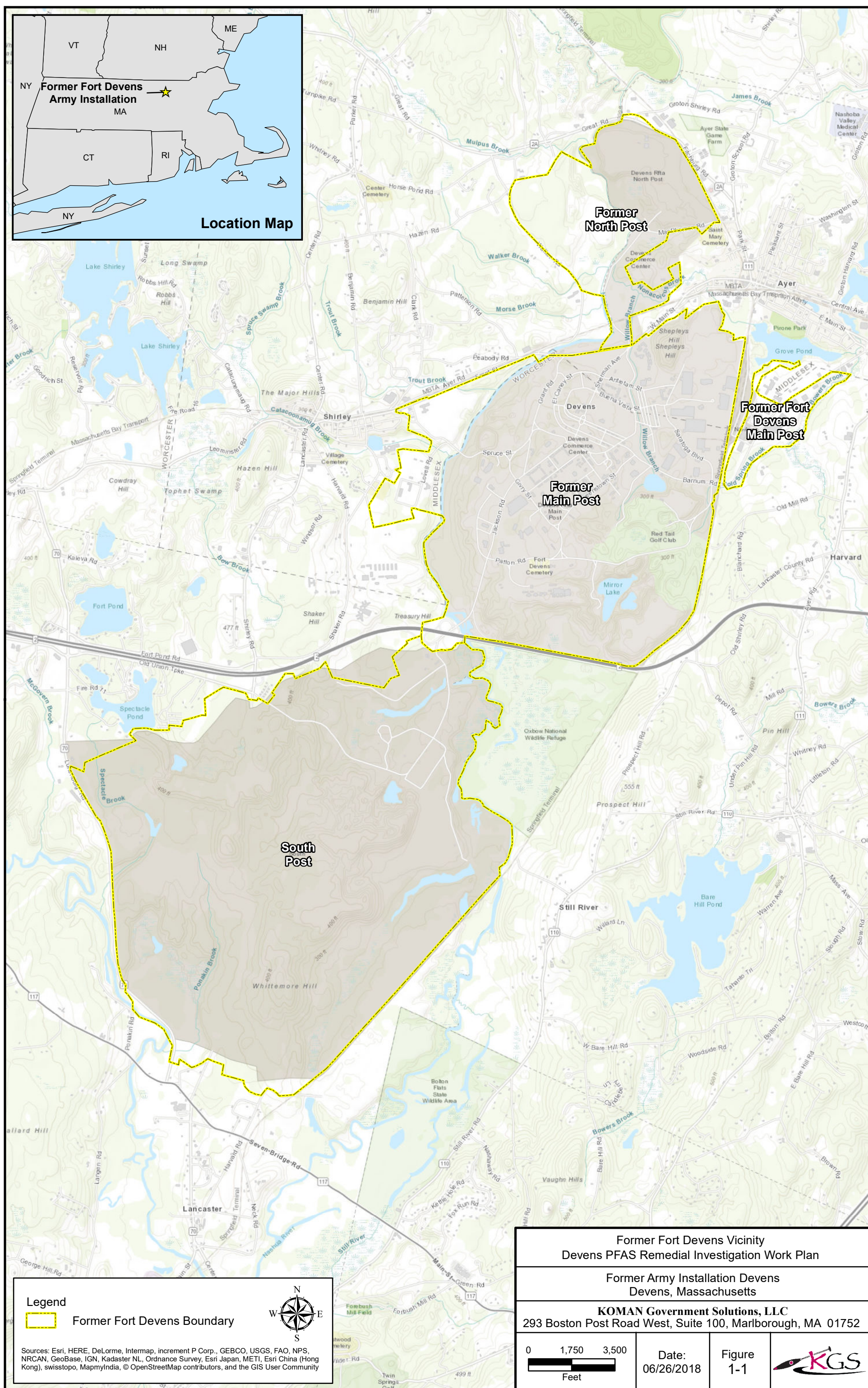
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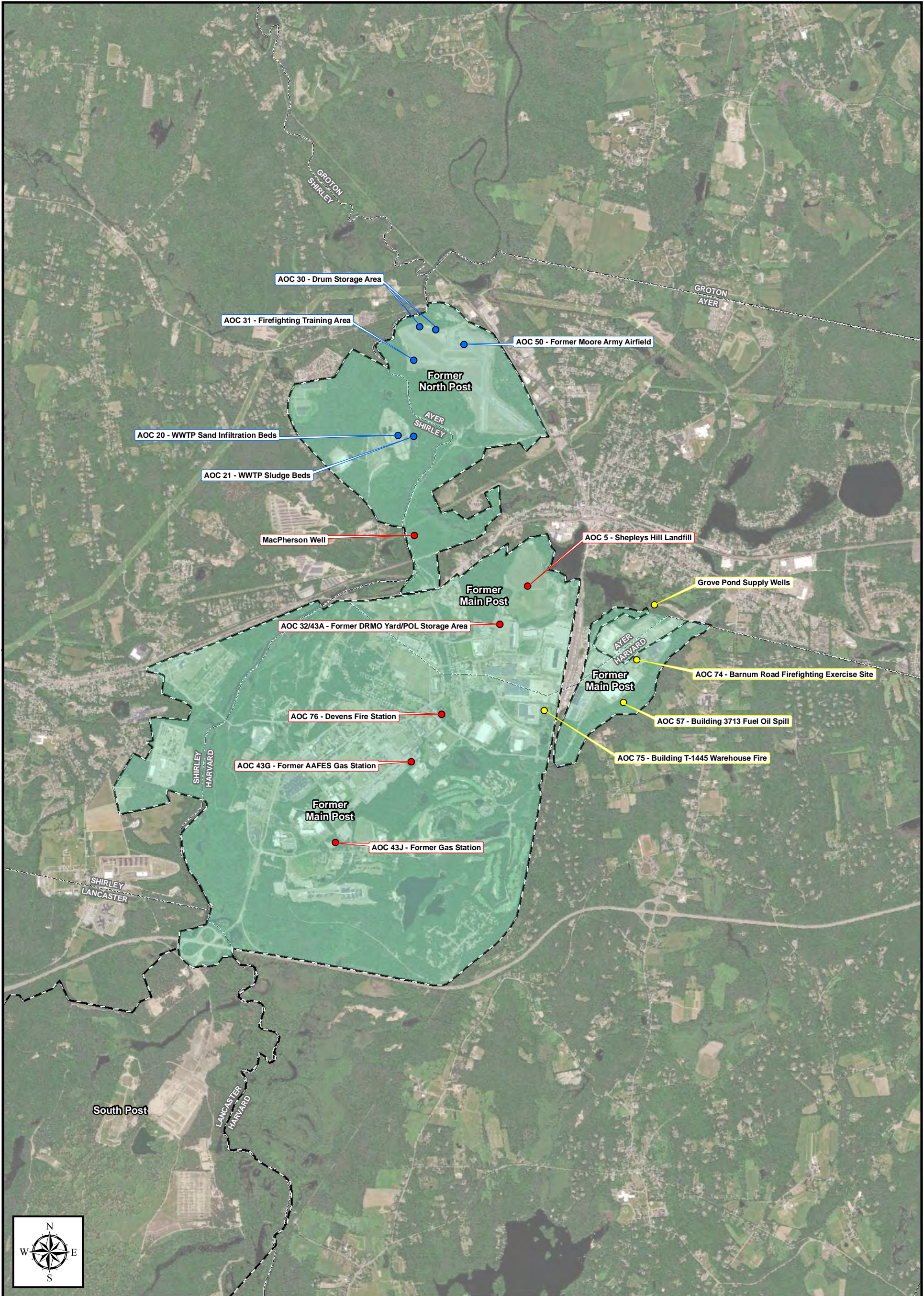
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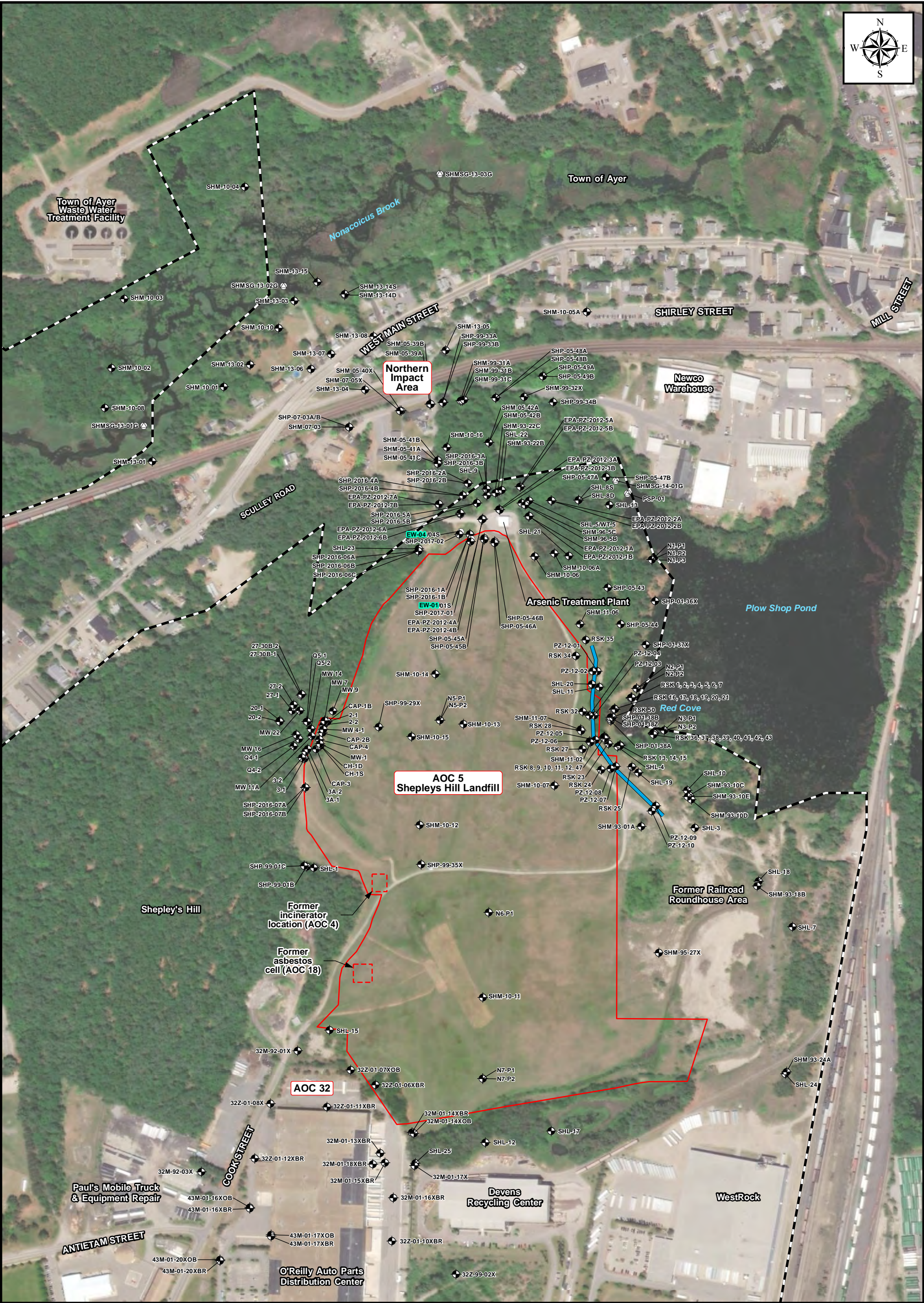
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Legend <ul style="list-style-type: none">Area 1 - Grove Pond Supply Wells, AOCs 57, 74, and 75Area 2 - MacPherson Water Supply Well, SHL, AOCs 32, 76, 43G and 43JArea 3 - AOCs 20, 21, 30, 31, and 50Devens Regional Enterprise ZoneCity/Town BoundaryFormer Fort Devens Boundary	Devens PFAS Remedial Investigation Areas Devens PFAS Remedial Investigation Work Plan		
	Former Army Installation Devens Devens, Massachusetts		
	KOMAN Government Solutions, LLC 293 Boston Post Road West, Suite 100, Marlborough, MA 01752		
	0 1,500 3,000 Feet	Date: 06/28/2018	Figure 1-2



File: PFAS2018_RL_WP_F1-3_AOC5_SHL_SL.mxd



- Legend
- Monitoring Well
 - Extraction Well
 - Stream Gauge
 - Barrier Wall
 - AOC5_Features
 - AOC 5 Boundary
 - Former Fort Devens Boundary
 - EW-01 Extraction Well

AOC 5 Site Layout
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

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06/26/2018

Figure
1-3



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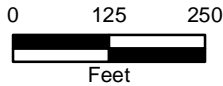
Legend

- Monitoring Well Location
- Area of Contamination (AOC)

AOC 20 and 21 Site Layout
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

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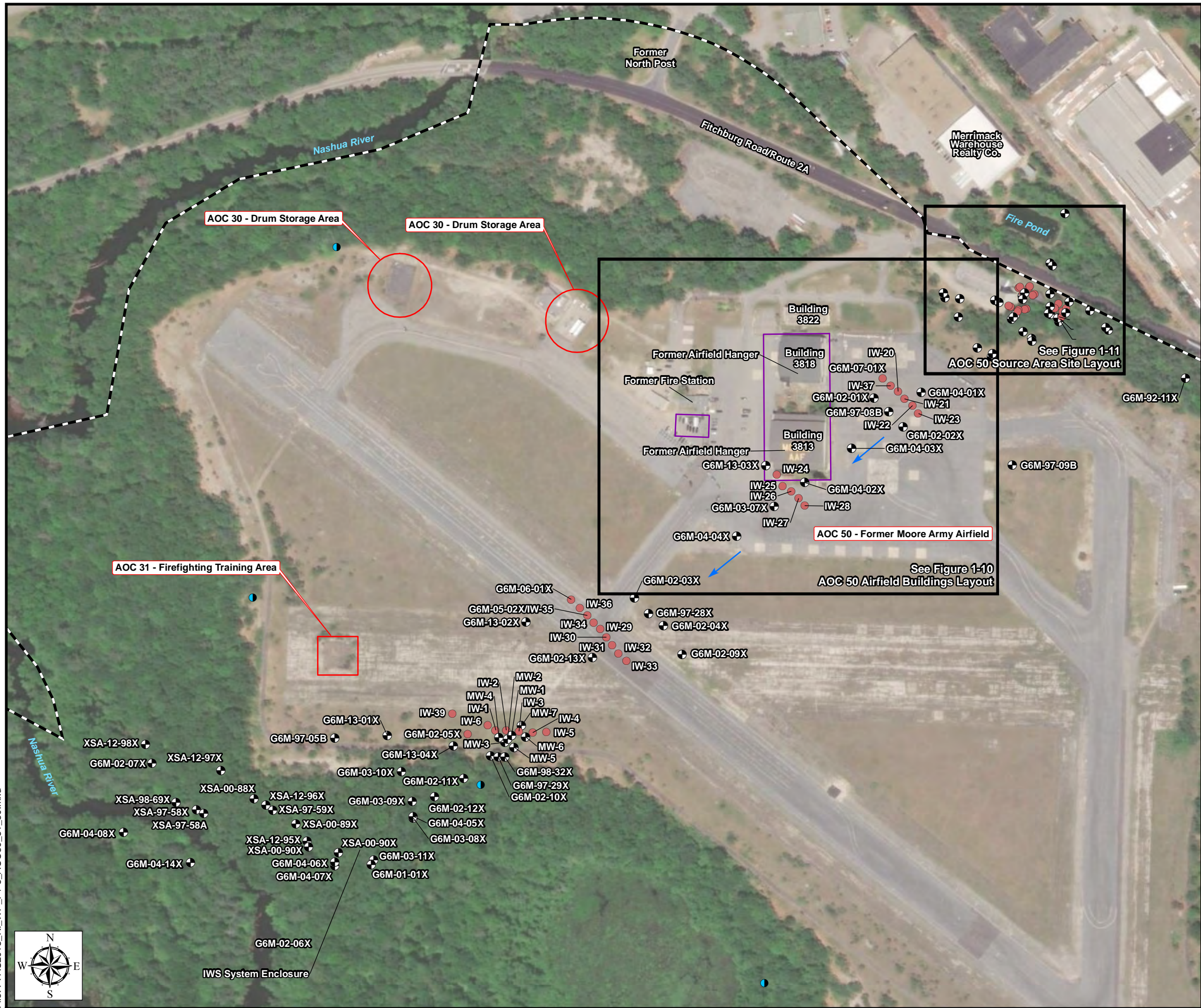


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Figure
1-4



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Legend

- Monitoring Well
- Injection Well
- Runway Stormwater Drain Outlet
- Groundwater Flow Direction
- Area of Contamination (AOC)
- Site Inspection Study Area Boundary
- Former Fort Devens Boundary

AOCs 30, 31, and 50 Site Layout
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

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Date:
06/28/2018

Figure
1-5





Legend

- Monitoring Well
- Former Storage Tank(s)
- Former Building
- T-247 Former Building Number
- Approximate Historical Extent of Groundwater Contamination in Exceedance of Cleanup Goals (based on April 2002 to October 2008 analytical data) (2008 Annual Report, HGL, 2009)
- TPHC Soil Contamination

Notes:

AST = Above ground storage tank
UST = Underground storage Tank
DRMO = Defense Reutilization and Marketing Office
TPHC = Total petroleum hydrocarbons

Aerial Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

AOC 32/43A Site Layout
Devens PFAS Remedial Investigation Workplan

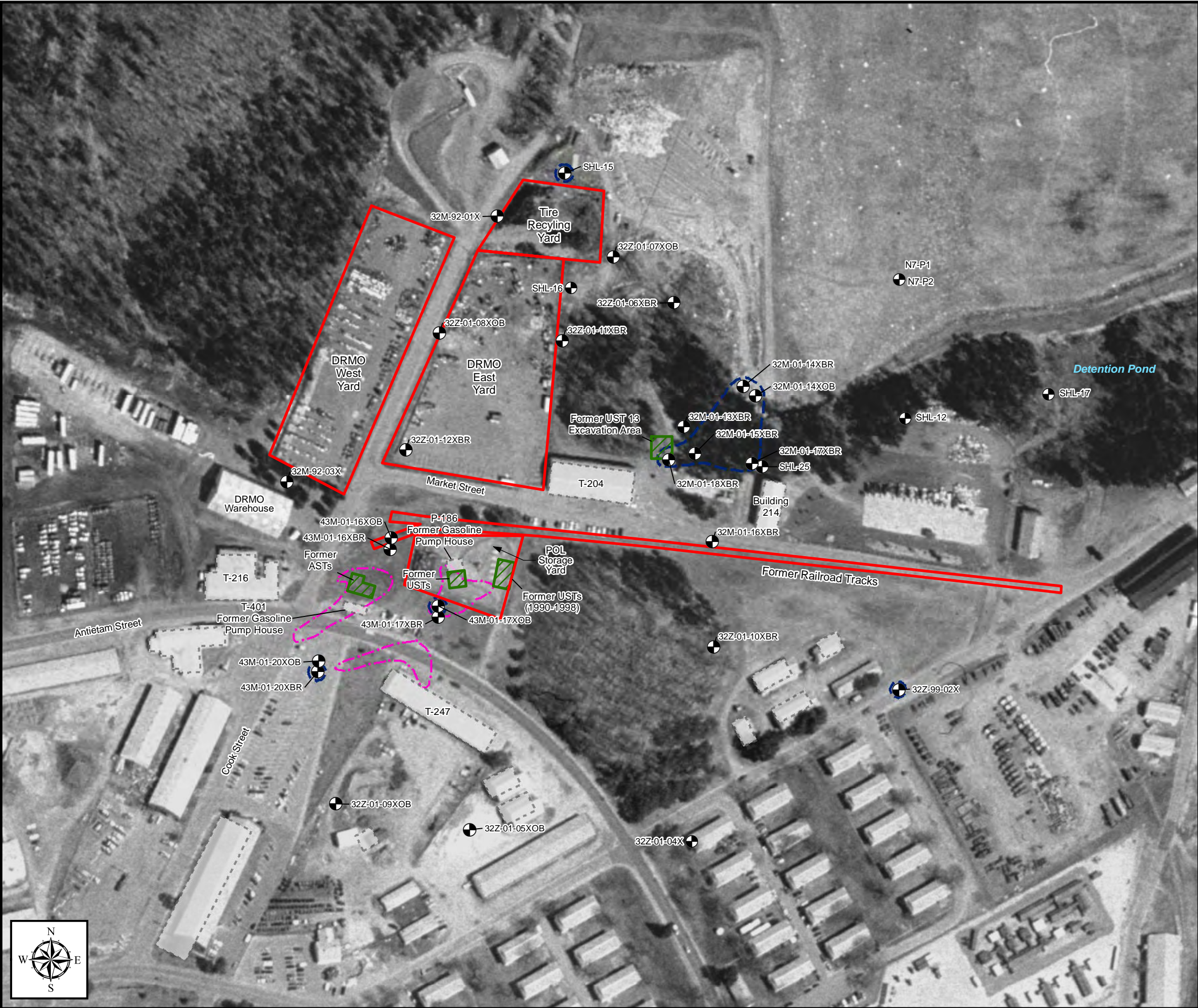
Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

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Figure
1-6



Legend

- Monitoring Well
- Former Storage Tank(s)
- Former Building
- T-247 Former Building Number
- Approximate Historical Extent of Groundwater Contamination in Exceedance of Cleanup Goals (based on April 2002 to October 2008 analytical data) (2008 Annual Report, HGL, 2009)
- TPHC Soil Contamination

Notes:

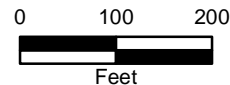
AST = Above ground storage tank
UST = Underground storage Tank
DRMO = Defense Reutilization and Marketing Office
TPHC = Total petroleum hydrocarbons

Aerial MassGIS

AOC 32/43A - 1995 Aerial Imagery
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

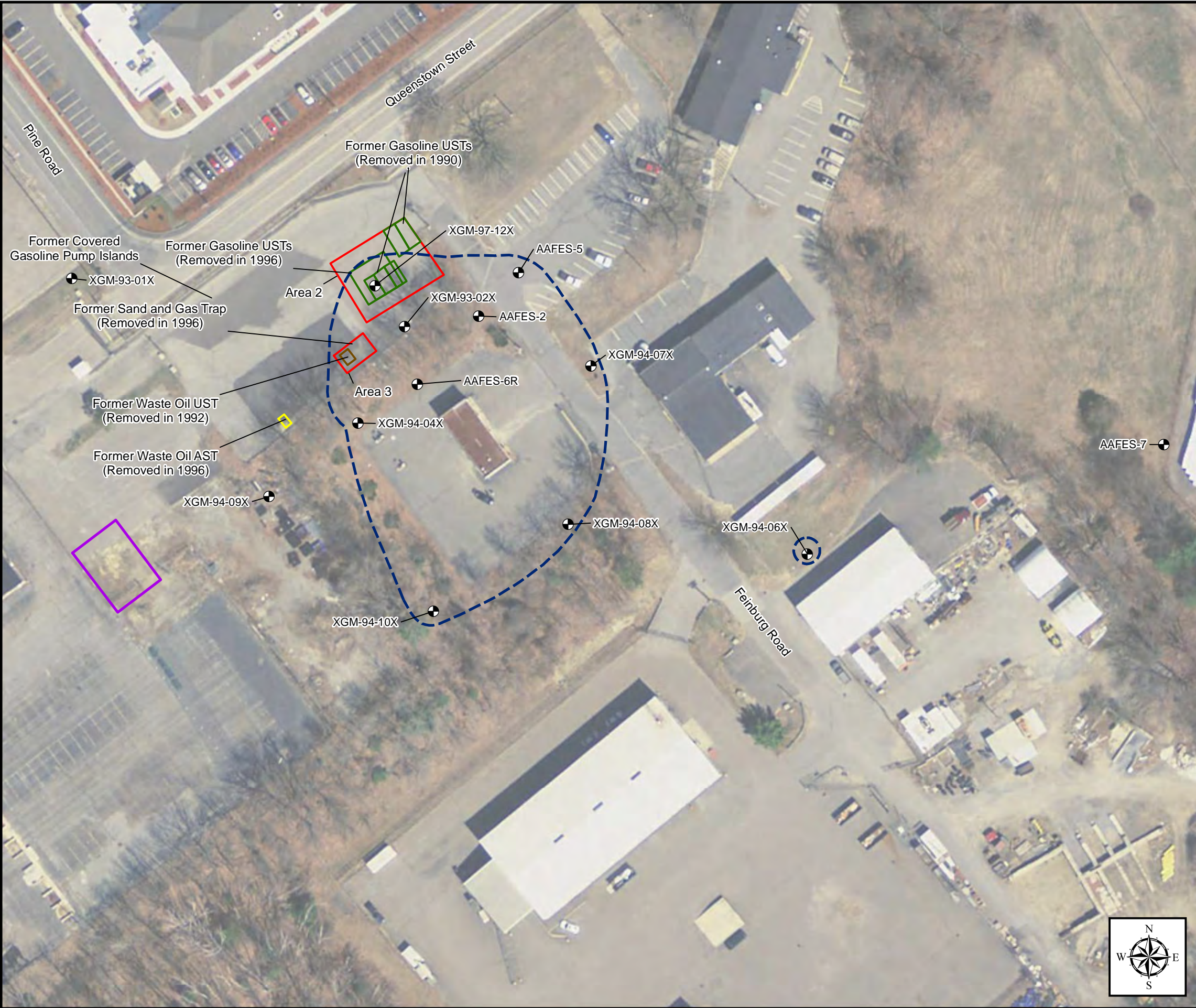
KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752



Date:
06/05/2018

Figure
1-7





Legend

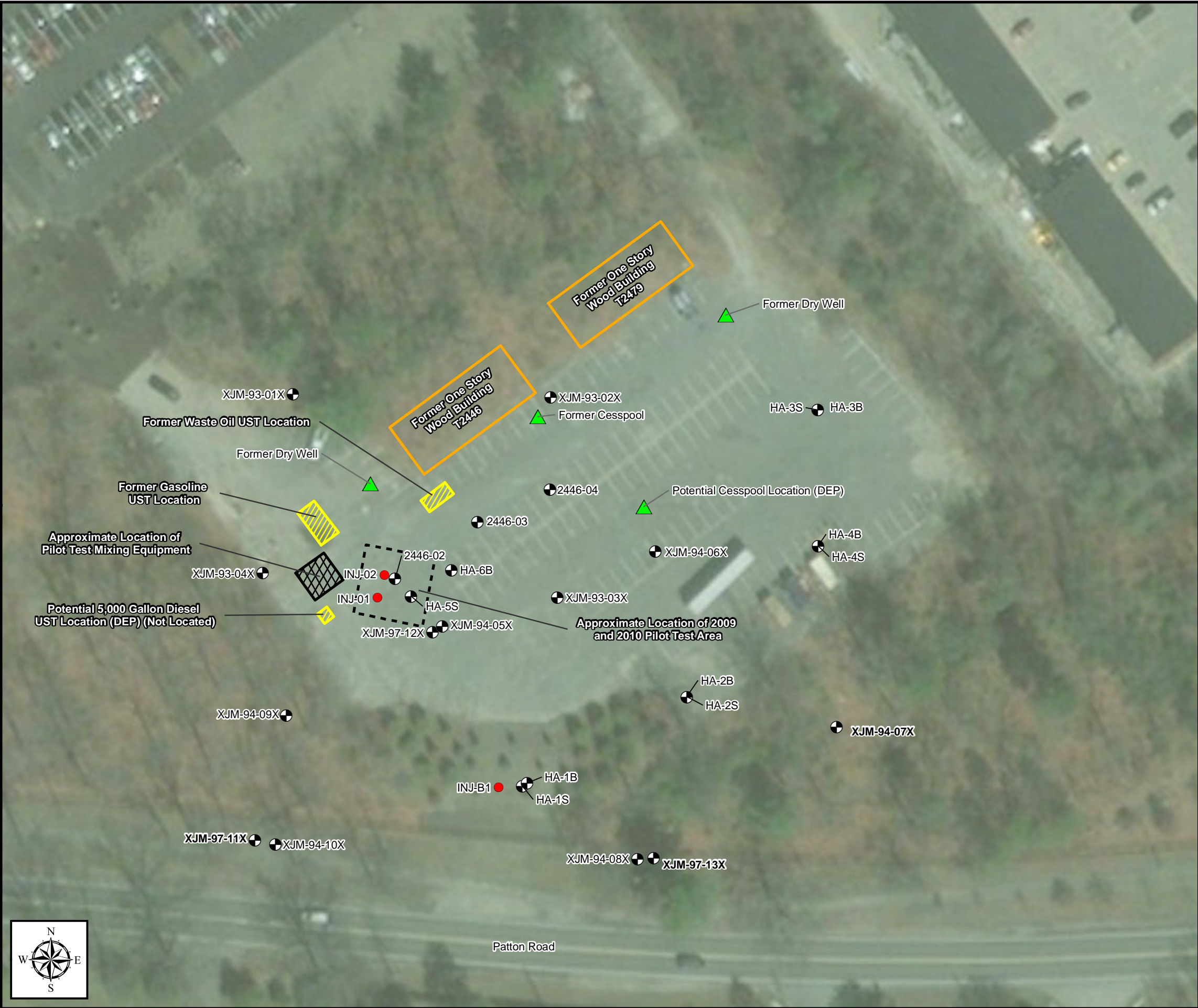
- Monitoring Well
- Approximate Historical Extent of Groundwater Contamination in Exceedance of Cleanup Goals (based on 1999 to 2008 analytical data) (2008 Annual Report, HGL, 2009)
- Area 1
- Former Gasoline UST(s)
- Former Waste Oil UST
- Former Waste Oil AST
- Former UST Area

Notes:

AST = Above ground storage tank
UST = Underground storage Tank

Aerial Sources: 2013, USGS, MassGIS

AOC 43G Site Layout Devens PFAS Remedial Investigation Workplan			
Former Fort Devens Army Installation Devens, Massachusetts			
KOMAN Government Solutions, LLC 293 Boston Post Road West, Suite 100, Marlborough, MA 01752			
0 40 80 Feet	Date: 06/05/2018	Figure 1-8	



- Legend
- ▲ Approximate Location of Potential Former Source Area Investigated
 - Monitoring Well
 - Injection Well
 - ▨ Approximate Location of Former UST
 - ⋯ Approximate Location of 2009 and 2010 Pilot Test Area
 - ▩ Approximate Location of Pilot Test Mixing Equipment
 - Former Building

References:
HGL. LTMMMP 2010, Haley Aldrich Inc. 2015

Aerial Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

AOC 43J Site Layout Devens PFAS Remedial Investigation Workplan			
Former Fort Devens Army Installation Devens, Massachusetts			
KOMAN Government Solutions, LLC 293 Boston Post Road West, Suite 100, Marlborough, MA 01752			
0 30 60 Feet	Date: 06/05/2018	Figure 1-9	

File: PFAS2018_RL_WP_F1-10_AOC50_Airfield_SL.mxd



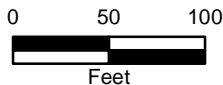
Legend

- Monitoring Well
- Injection Well
- Site Inspection Study Area Boundary

AOC 50 Airfield Buildings Layout
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

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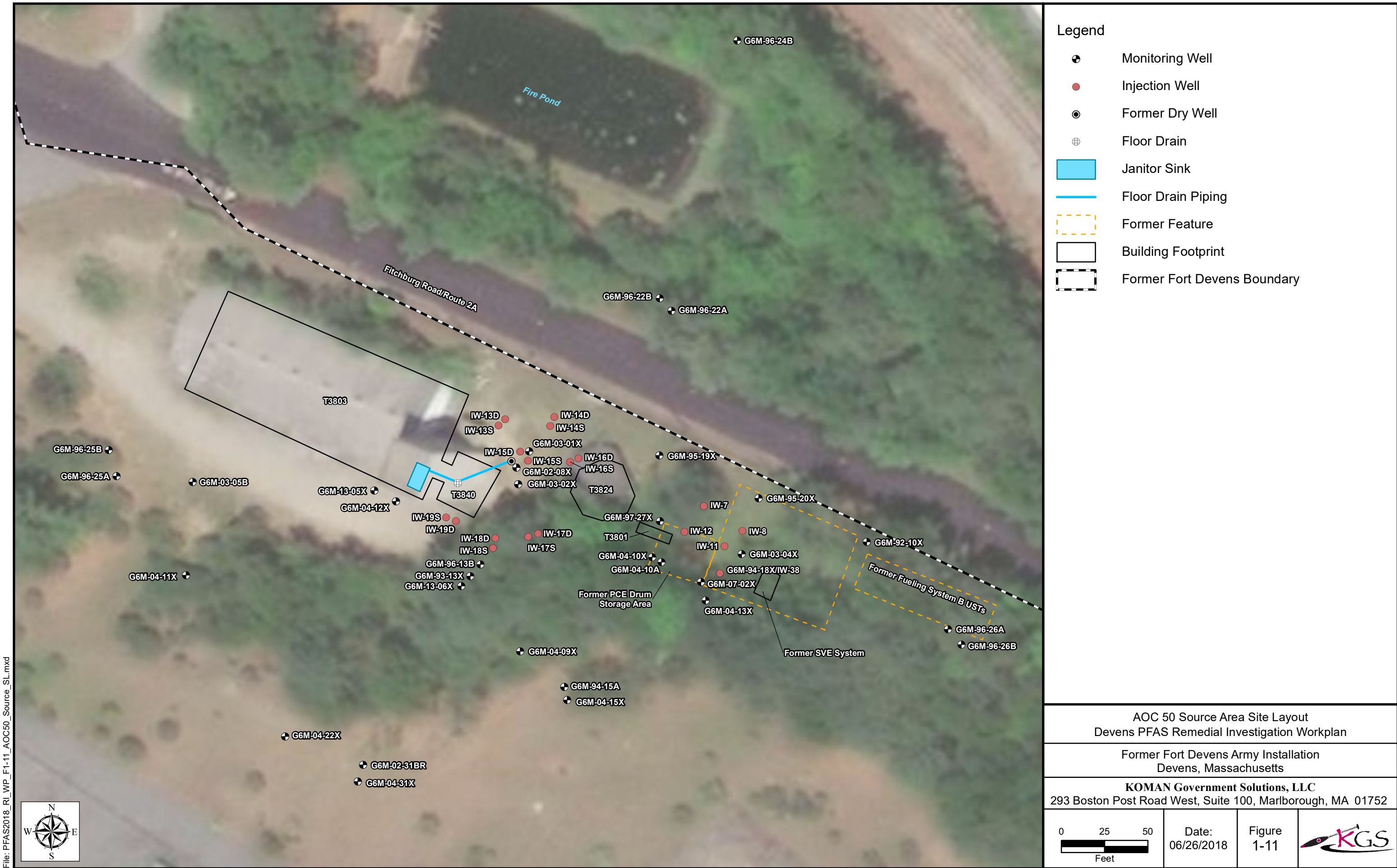


Date:
06/27/2018

Figure
1-10



File: PFAS2018_RL_WP_F1-11_AOC50_Source_SL.mxd





- Legend**
- Public Water Supply Well
 - Topographic Contour (feet above sea level)
 - Area of Contamination (AOC)
 - Massachusetts Army National Guard Property
 - US Army Property
 - Former Fort Devens Boundary

Note:
Topographic Contour Source: MassGIS, Elevation Contours (1:5,000) - North American Vertical Datum of 1988.

AOC 57, 74 and 75 Site Layout and Grove Pond Wellfield
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
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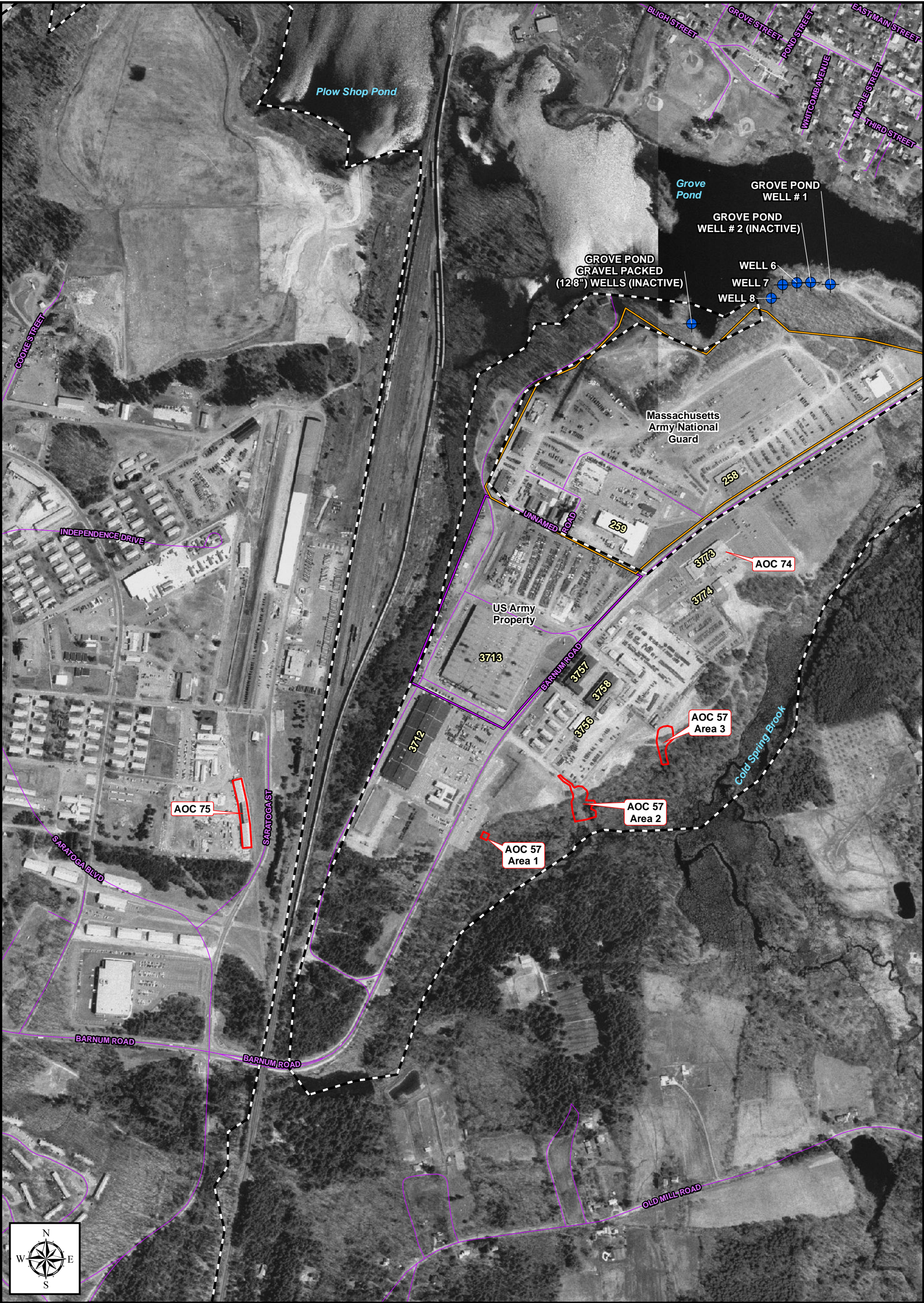
0 200 400
Feet

Date:
06/26/2018

Figure
1-12



File: PFAS2018_RL_WP_F1-13_AOC57_74_75_1992Image.mxd



- Legend
- Public Water Supply Well
 - Area of Contamination (AOC)
 - Current Road
 - Massachusetts Army National Guard Property
 - US Army Property
 - Former Fort Devens Boundary

AOC 57, 74, 75 - 1992 Aerial Imagery
Devens PFAS Remedial Investigation Work Plan

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
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0 300 600
Feet






Date:
06/26/2018

Figure
1-13





Legend

-  Approximate Extent of Excavation (1994)
-  Topographic Contour (feet above sea level)
-  Stream
-  Area of Contamination (AOC)
-  Former Fort Devens Boundary

Note:

Topographic Contour Source: MassGIS, Elevation Contours (1:5,000) - North American Vertical Datum of 1988.

Aerial Sources: 2013, USGS, MassGIS

AOC 57 Area 1 Site Layout
Devens PFAS Remedial Investigation Work Plan

Former Fort Devens Army Installation
Devens, Massachusetts

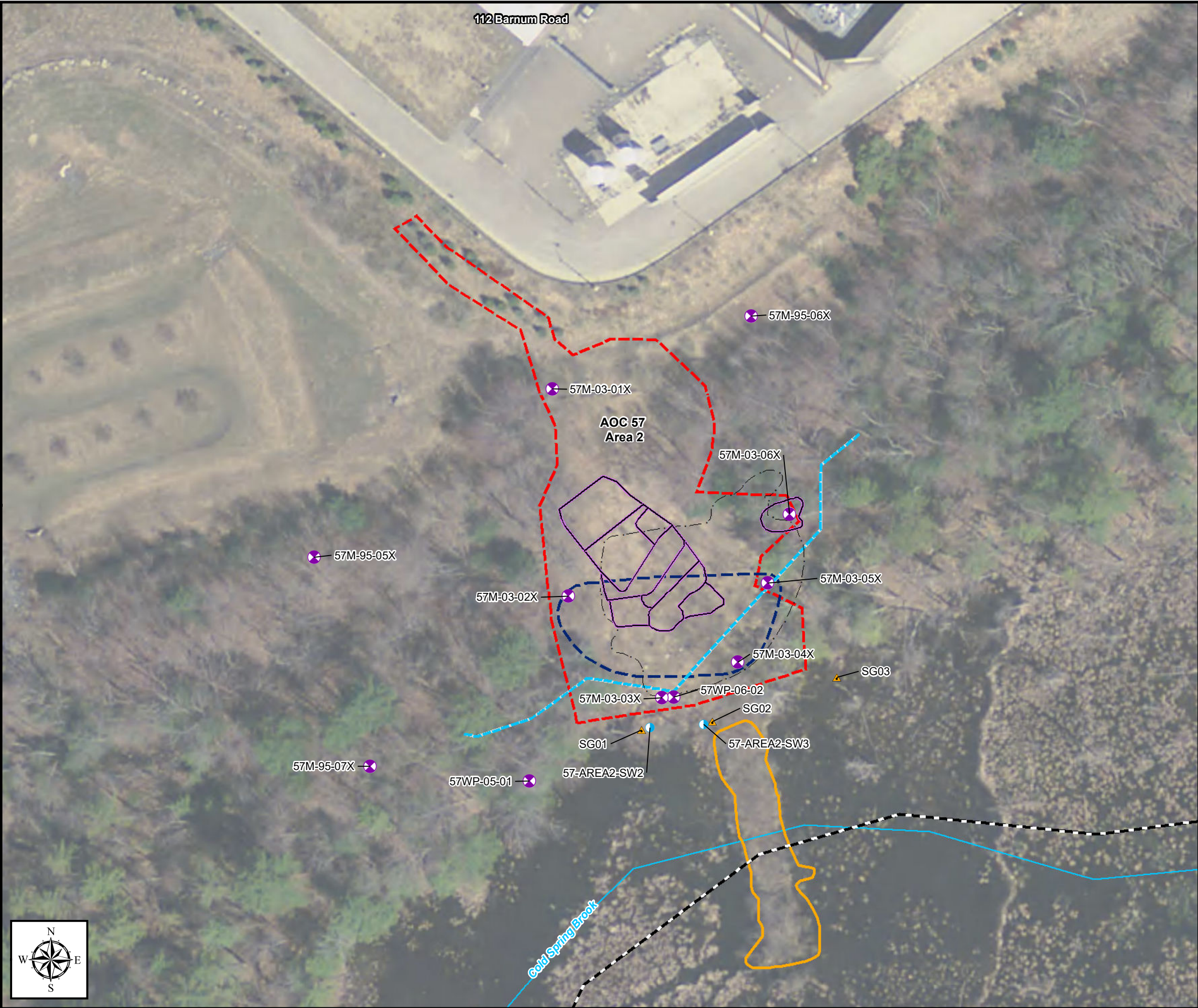
KOMAN Government Solutions, LLC
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Date:
06/05/2018

Figure
1-14





Legend

- LTM Well - Gauge Only
- Staff Gauge
- Surface Water Sample Location
- Well/Piezometer/Sample Location Identification
- Final Excavation Limit (2003)
- Conti Excavation Limit (2002)
- Former Fort Devens Boundary
- Flagged Wetland Limits
- Approximate Historical Extent of Groundwater Contamination in Exceedance of Cleanup Goals (based on Fall 2003 to Spring 2008 analytical data) (2008 Annual Report, HGL, 2009)
- Containment Dam
- Area of Contamination (AOC)
- Stream

Note:
Aerial Sources: 2013, USGS, MassGIS

AOC 57 Area 2 Site Layout
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

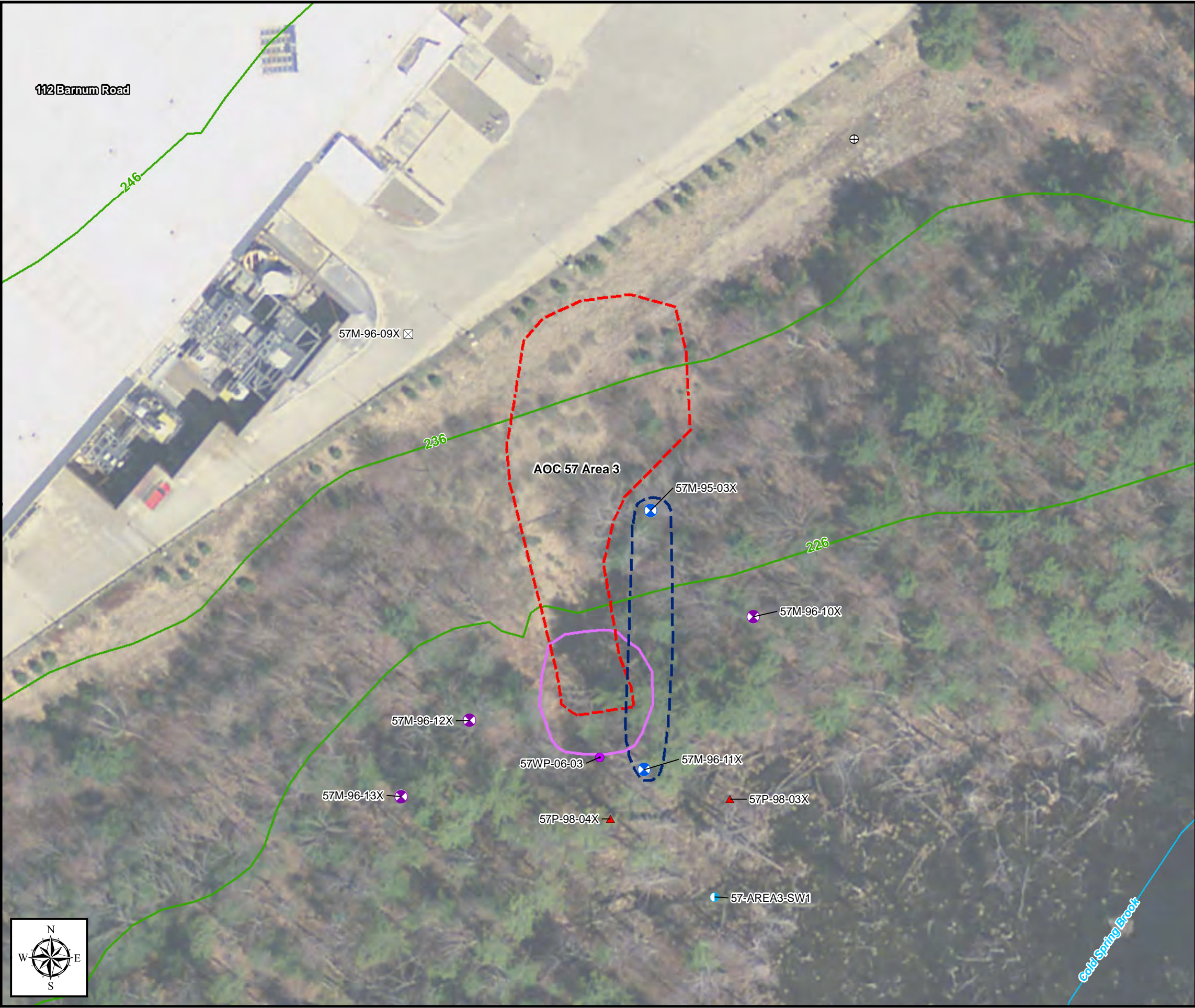
KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752



Date:
06/26/2018

Figure
1-15





Legend

- LTM Sample Well
- LTM Well - Gauge Only
- Well Point - Gauge Only
- LTM Piezometer
- Surface Water Sample Location
- Monitoring Well - Abandoned (2012)
- Monitoring Well - Destroyed
- Well/Piezometer/Sample Location Identification
- Approximate Historical Extent of Groundwater Contamination in Exceedance of Cleanup Goals (based on Fall 2003 to Spring 2008 analytical data) (2008 Annual Report, HGL, 2009)
- Area of Contamination (AOC)
- Alternate III-2a Estimated Soil Excavation Area
- Stream
- Topographic Contour (Ft AMSL)

Notes:

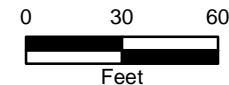
Well 57M-96-09X buried by construction.
LTM = Long-term monitoring

Aerial Sources: 2013, USGS, MassGIS

AOC 57 Area 3 Site Layout
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
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Date:
06/11/2018



Figure
1-16



File: PFAS2018_RL_WP_F1-17_AOC76_SL.mxd



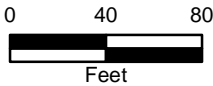
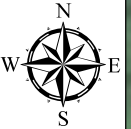
Legend

-  Temporary Well Location from SI
-  Potential Source Area

AOC 76 Site Layout
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

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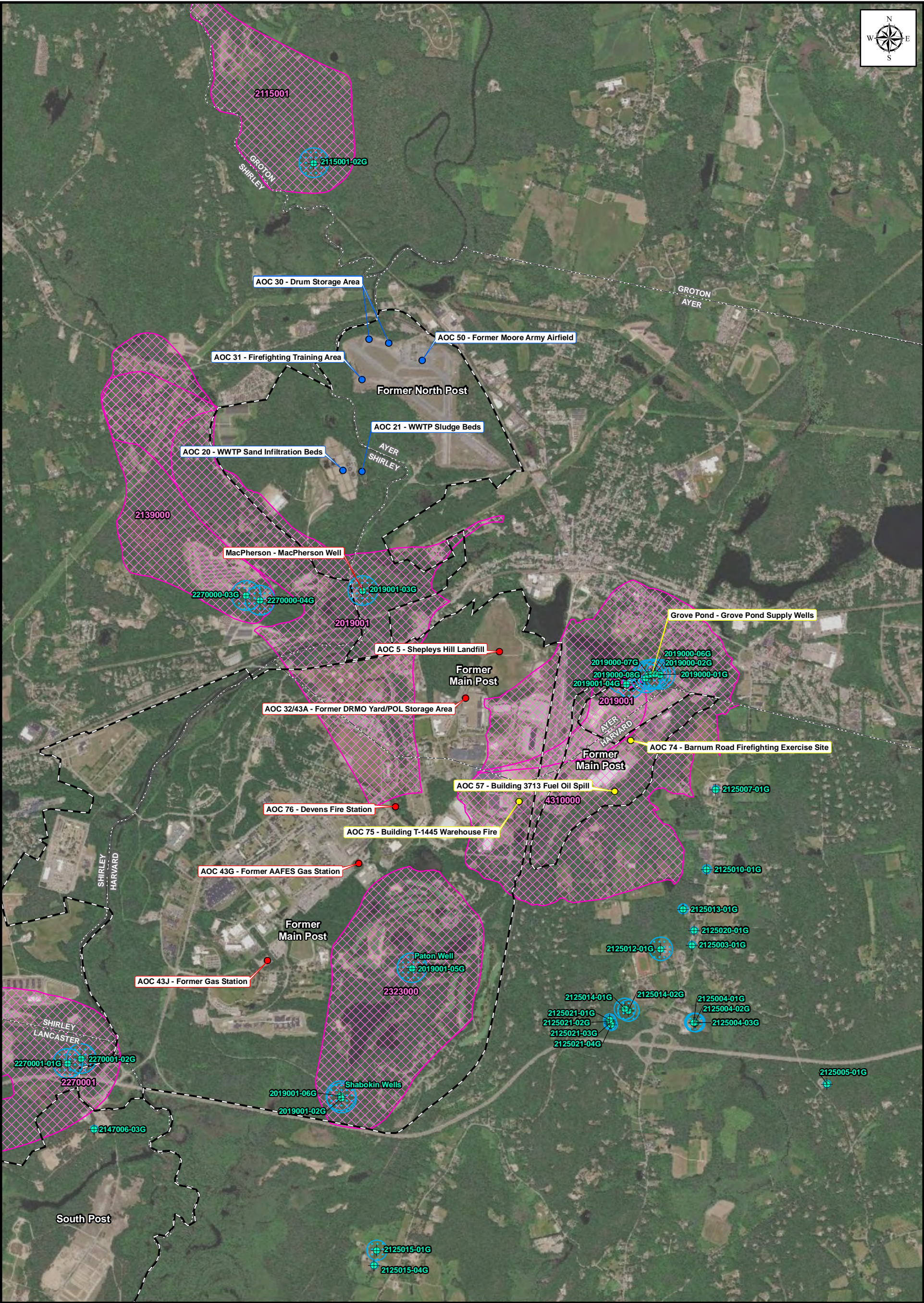


Date:
06/05/2018

Figure
1-17

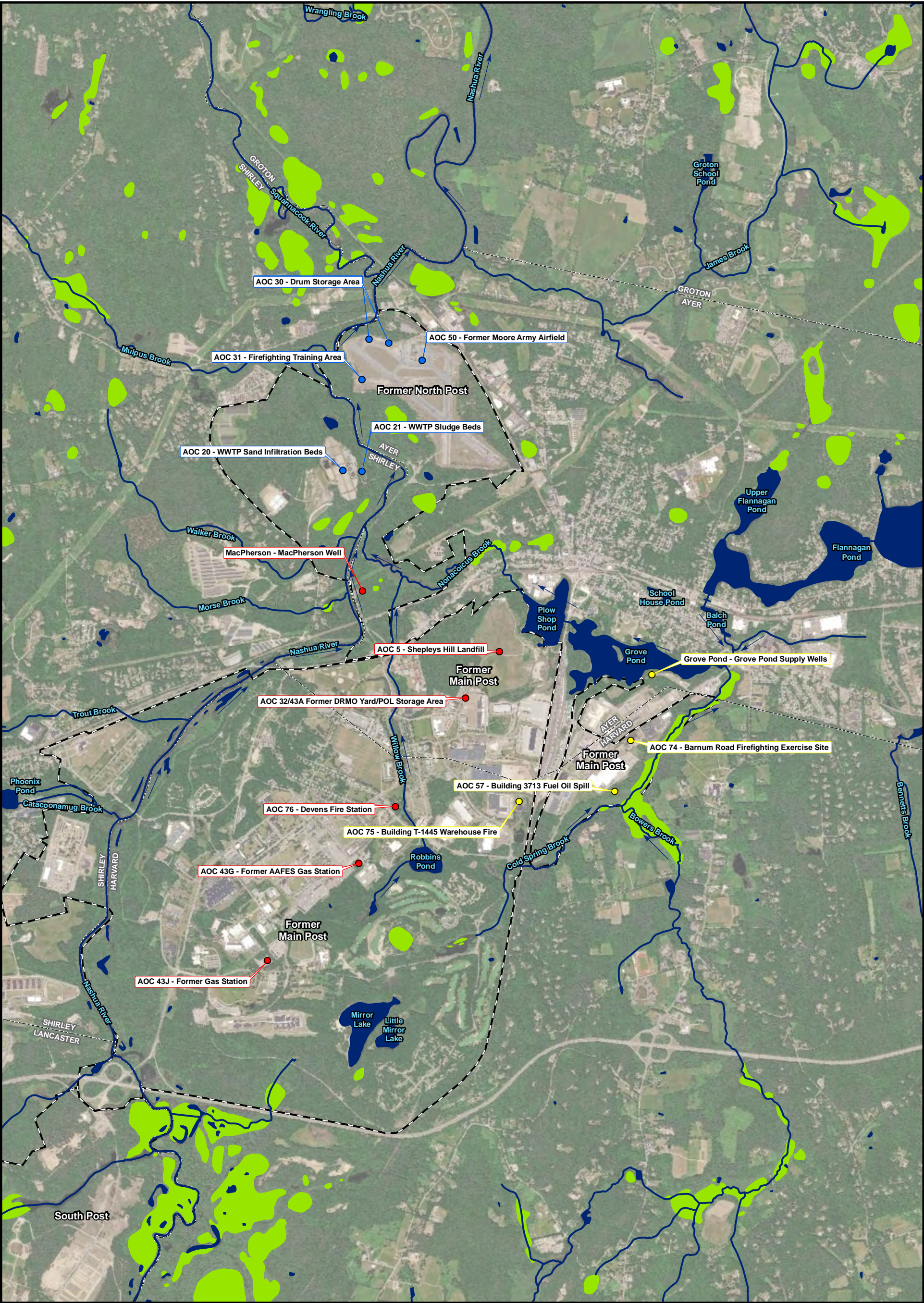


File: PFAS2018_RL_WP_F1-18_PWSWells.mxd



Legend <div><div><div><div><div></div><div></div></div><div>Public Water Supply Well</div></div><div><div><div></div><div></div></div><div>Area 1 - Grove Pond Supply Wells, AOCs 57, 74, and 75</div></div><div><div><div></div><div></div></div><div>Area 2 - MacPherson Water Supply Well, SHL, AOCs 32/43A, 76, 43G and 43J</div></div><div><div><div></div><div></div></div><div>Area 3 - AOCs 20, 21, 30, 31, and 50</div></div><div><div><div></div><div></div></div><div>City/Town Boundary</div></div><div><div><div></div><div></div></div><div>Former Fort Devens Boundary</div></div></div><div><div><div></div><div></div></div><div>DEP Approved Zone I</div></div><div><div><div></div><div></div></div><div>DEP Approved Zone II</div></div></div>		Public Water Supply Wells Devens PFAS Remedial Investigation Workplan		
		Former Army Installation Devens Devens, Massachusetts		
		KOMAN Government Solutions, LLC 293 Boston Post Road West, Suite 100, Marlborough, MA 01752		
<div><div>0</div><div>1,250</div><div>2,500</div><div>Feet</div></div>		Date: 06/26/2018	Figure 1-18	

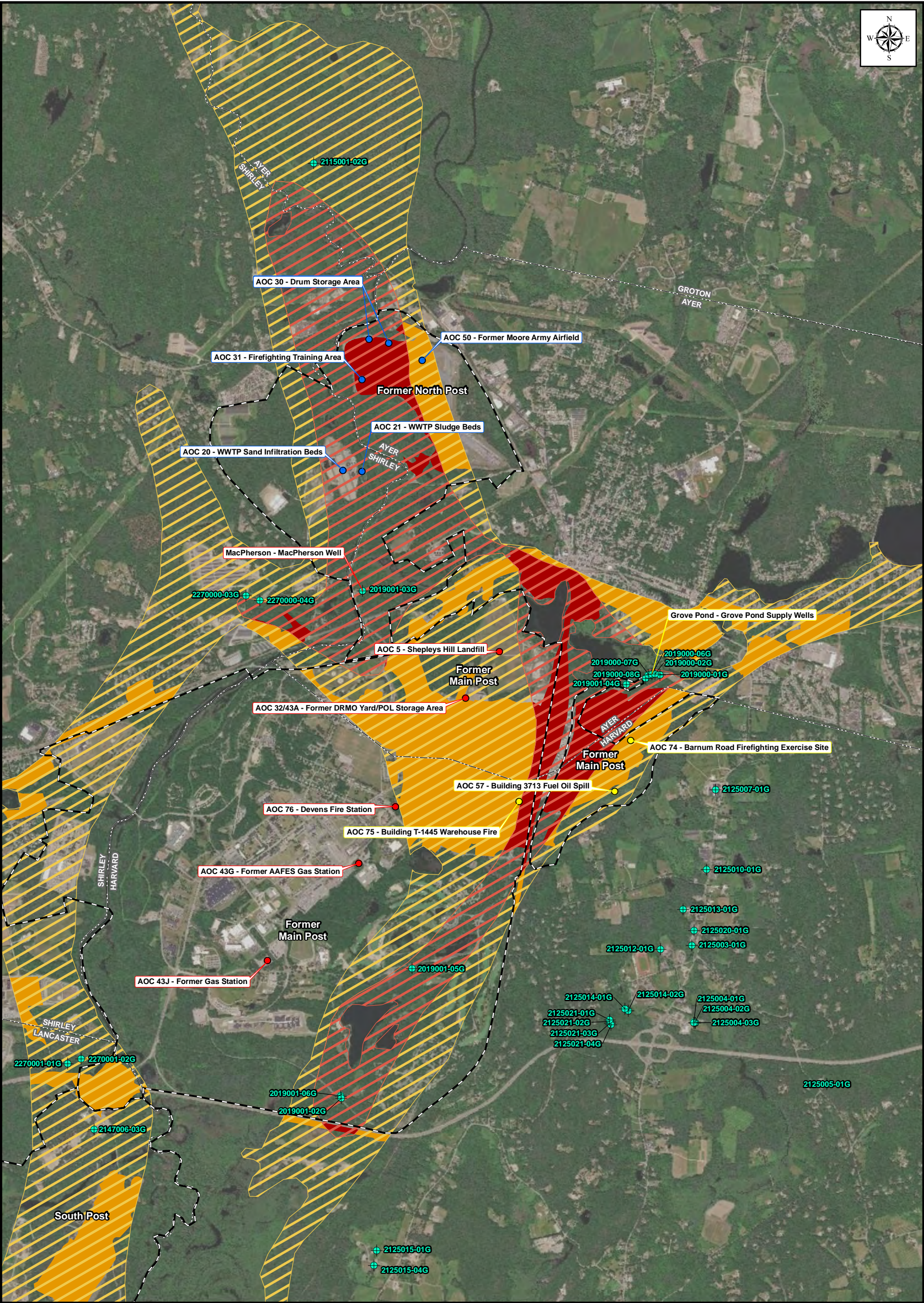
File: PFAS2018_RL_WP_F3-1_SurfaceWaterBodies_NHD.mxd



Legend			
	Area 1 - Grove Pond Supply Wells, AOCs 57, 74, and 75	National Hydrography Dataset	
	Area 2 - MacPherson Water Supply Well, SHL, AOCs 32/43A, 76, 43G and 43J		Stream/River
	Area 3 - AOCs 20, 21, 30, 31, and 50		Lake/Pond
	Surface Water Flow Direction		Swamp/Marsh
	City/Town Boundary		
	Former Fort Devens Boundary		

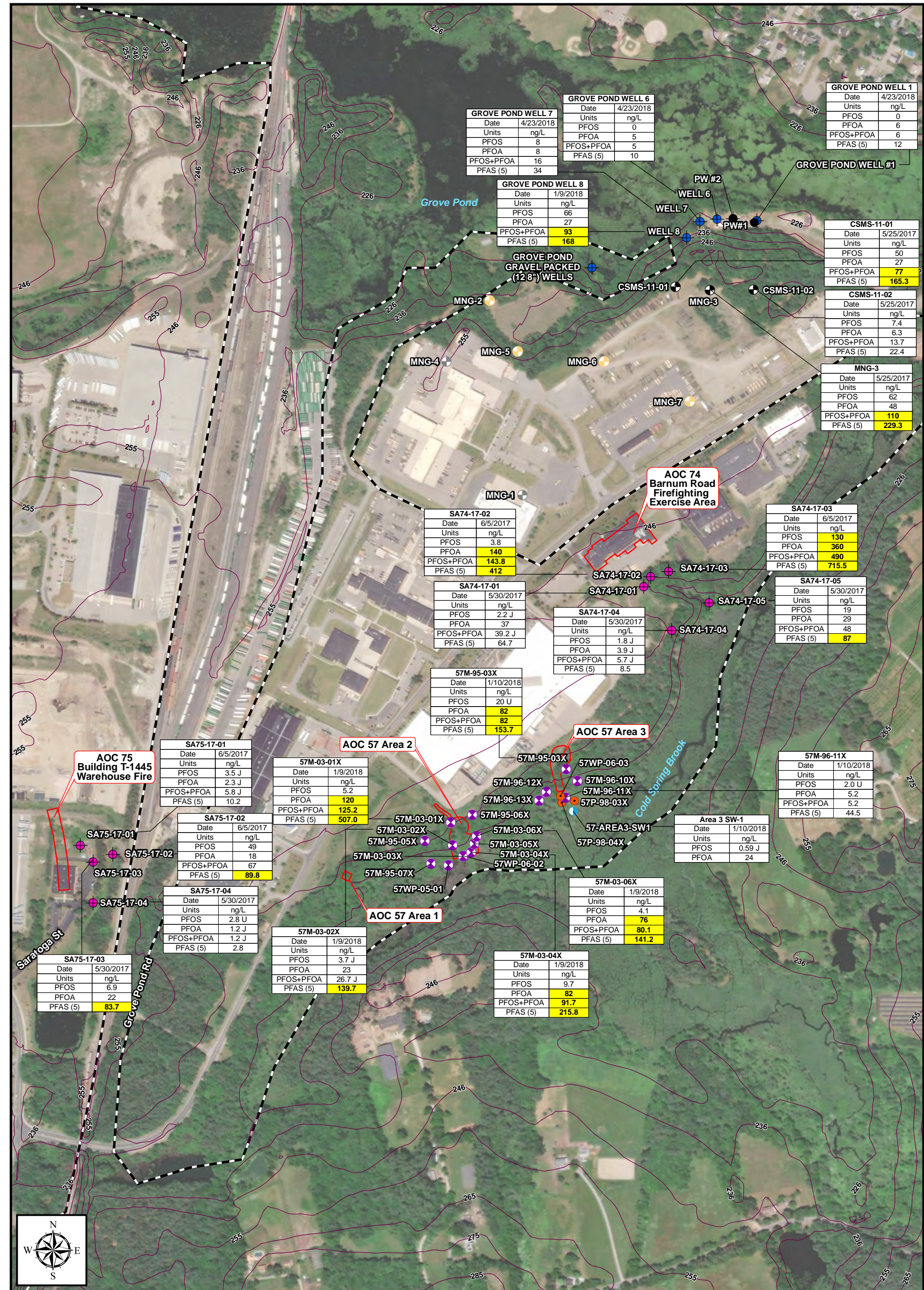
Surface Water Bodies Devens PFAS Remedial Investigation Workplan		
Former Army Installation Devens Devens, Massachusetts		
KOMAN Government Solutions, LLC 293 Boston Post Road West, Suite 100, Marlborough, MA 01752		
0 1,250 2,500 Feet	Date: 06/28/2018	Figure 3-1

File: PFAS2018_RI_WP_F3-2_HighYieldAquifers.mxd



Legend		Aquifers	
	Public Water Supply Well		High Yield
	Area 1 - Grove Pond Supply Wells, AOCs 57, 74, and 75		Medium Yield
	Area 2 - MacPherson Water Supply Well, SHL, AOCs 32/43A, 76, 43G and 43J	Non Potential Drinking Water Source Area	
	Area 3 - AOCs 20, 21, 30, 31, and 50		High Yield
	City/Town Boundary		Medium Yield
	Former Fort Devens Boundary		

High Yield Aquifers Devens PFAS Remedial Investigation Workplan			
Former Army Installation Devens Devens, Massachusetts			
KOMAN Government Solutions, LLC 293 Boston Post Road West, Suite 100, Marlborough, MA 01752			
0 1,250 2,500 Feet	Date: 06/28/2018	Figure 3-2	



GROVE POND WELL 7	
Date	4/23/2018
Units	ng/L
PFOS	8
PFOA	8
PFOS+PFOA	16
PFAS (5)	34

GROVE POND WELL 6	
Date	4/23/2018
Units	ng/L
PFOS	0
PFOA	5
PFOS+PFOA	5
PFAS (5)	10

GROVE POND WELL 1	
Date	4/23/2018
Units	ng/L
PFOS	0
PFOA	6
PFOS+PFOA	6
PFAS (5)	12

GROVE POND WELL 8	
Date	1/9/2018
Units	ng/L
PFOS	66
PFOA	27
PFOS+PFOA	93
PFAS (5)	168

CSMS-11-01	
Date	5/25/2017
Units	ng/L
PFOS	50
PFOA	27
PFOS+PFOA	77
PFAS (5)	165.3

CSMS-11-02	
Date	5/25/2017
Units	ng/L
PFOS	7.4
PFOA	6.3
PFOS+PFOA	13.7
PFAS (5)	22.4

MNG-3	
Date	5/25/2017
Units	ng/L
PFOS	62
PFOA	48
PFOS+PFOA	110
PFAS (5)	229.3

SA74-17-02	
Date	6/5/2017
Units	ng/L
PFOS	3.8
PFOA	140
PFOS+PFOA	143.8
PFAS (5)	412

SA74-17-03	
Date	6/5/2017
Units	ng/L
PFOS	130
PFOA	360
PFOS+PFOA	490
PFAS (5)	715.5

SA74-17-01	
Date	5/30/2017
Units	ng/L
PFOS	2.2 J
PFOA	37
PFOS+PFOA	39.2 J
PFAS (5)	64.7

SA74-17-04	
Date	5/30/2017
Units	ng/L
PFOS	1.8 J
PFOA	3.9 J
PFOS+PFOA	5.7 J
PFAS (5)	8.5

SA74-17-05	
Date	5/30/2017
Units	ng/L
PFOS	19
PFOA	29
PFOS+PFOA	48
PFAS (5)	87

57M-95-03X	
Date	1/10/2018
Units	ng/L
PFOS	20 U
PFOA	82
PFOS+PFOA	82
PFAS (5)	153.7

57M-96-11X	
Date	1/10/2018
Units	ng/L
PFOS	2.0 U
PFOA	5.2
PFOS+PFOA	5.2
PFAS (5)	44.5

SA75-17-01	
Date	6/5/2017
Units	ng/L
PFOS	3.5 J
PFOA	2.3 J
PFOS+PFOA	5.8 J
PFAS (5)	10.2

57M-03-01X	
Date	1/9/2018
Units	ng/L
PFOS	5.2
PFOA	120
PFOS+PFOA	125.2
PFAS (5)	507.0

SA75-17-02	
Date	6/5/2017
Units	ng/L
PFOS	49
PFOA	18
PFOS+PFOA	67
PFAS (5)	89.8

SA75-17-04	
Date	5/30/2017
Units	ng/L
PFOS	2.8 U
PFOA	1.2 J
PFOS+PFOA	1.2 J
PFAS (5)	2.8

SA75-17-03	
Date	5/30/2017
Units	ng/L
PFOS	6.9
PFOA	22
PFAS (5)	83.7

57M-03-02X	
Date	1/9/2018
Units	ng/L
PFOS	3.7 J
PFOA	23
PFOS+PFOA	26.7 J
PFAS (5)	139.7

57M-03-04X	
Date	1/9/2018
Units	ng/L
PFOS	9.7
PFOA	82
PFOS+PFOA	91.7
PFAS (5)	215.8

57M-03-06X	
Date	1/9/2018
Units	ng/L
PFOS	4.1
PFOA	76
PFOS+PFOA	80.1
PFAS (5)	141.2

Area 3 SW-1	
Date	1/10/2018
Units	ng/L
PFOS	0.59 J
PFOA	24

File: PFAS2018_RL_WP_F3-3_GW_Area1.mxd

- Legend**
- LTM Well
 - LTM Well Point or Piezometer
 - Surface Water Sample Location
 - Monitoring Well
 - Monitoring Well (Damaged)
 - Monitoring Well (Destroyed)
 - Historical Supply Well
 - Temporary Well Location from SI
 - Public Water Supply Well

- Topographic Contour (feet above sea level)
- Area of Contamination (AOC)
- Former Fort Devens Boundary

Notes:
Topographic Contour Source: MassGIS,
Elevation Contours (1:5,000) - North
American Vertical Datum of 1988.

Bold/highlighted results exceed EPA LHA
of 70 ng/L for separate or combined
PFOS +PFOA and/or exceed MA ORSG
of 70 ng/L for the combined
concentrations of PFOS, PFOA, PFHxS,
PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid
(PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohexanoic Acid (PFHpA)

ng/L = nanograms per liter
J = estimated result
U = non-detect

Area 1 PFOS and PFOA Detections in Groundwater and Surface Water
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

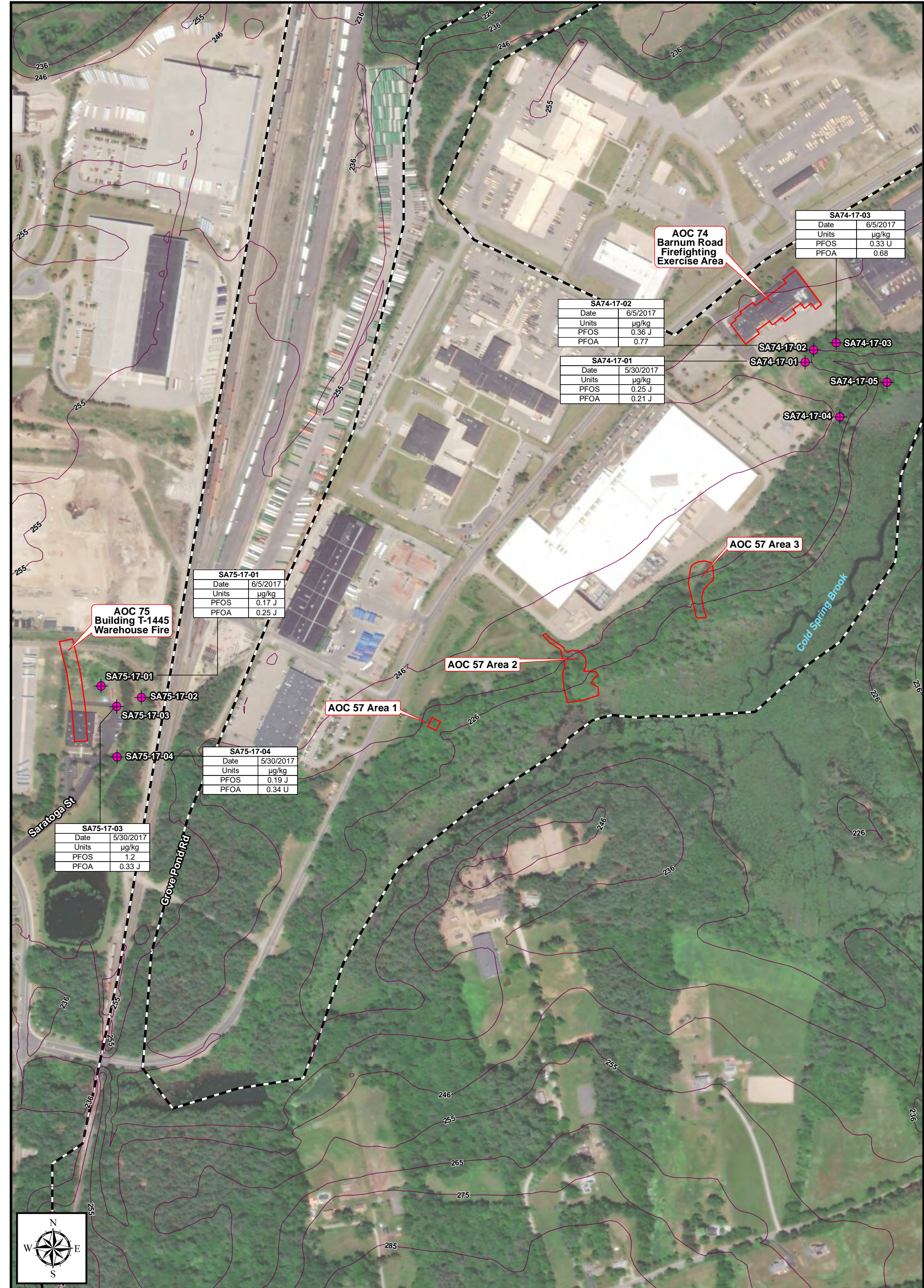
KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

0 250 500
Feet

Date:
06/28/2018

Figure
3-3





SA74-17-03	
Date	6/5/2017
Units	µg/kg
PFOS	0.33 U
PFOA	0.68

SA74-17-02	
Date	6/5/2017
Units	µg/kg
PFOS	0.36 J
PFOA	0.77

SA74-17-01	
Date	5/30/2017
Units	µg/kg
PFOS	0.25 J
PFOA	0.21 J

SA75-17-01	
Date	6/5/2017
Units	µg/kg
PFOS	0.17 J
PFOA	0.25 J

SA75-17-04	
Date	5/30/2017
Units	µg/kg
PFOS	0.19 J
PFOA	0.34 U

SA75-17-03	
Date	5/30/2017
Units	µg/kg
PFOS	1.2
PFOA	0.33 J



- Legend**
- Temporary Well Location from SI
 - Topographic Contour (feet above sea level)
 - Area of Contamination (AOC)
 - Former Fort Devens Boundary

Notes:

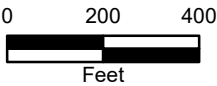
Topographic Contour Source: MassGIS, Elevation Contours (1:5,000) - North American Vertical Datum of 1988.

PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
µg/Kg = micrograms per Kilogram
J = Estimated Results
U = Non-Detect

Area 1 PFOS and PFOA Detections in Soil
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

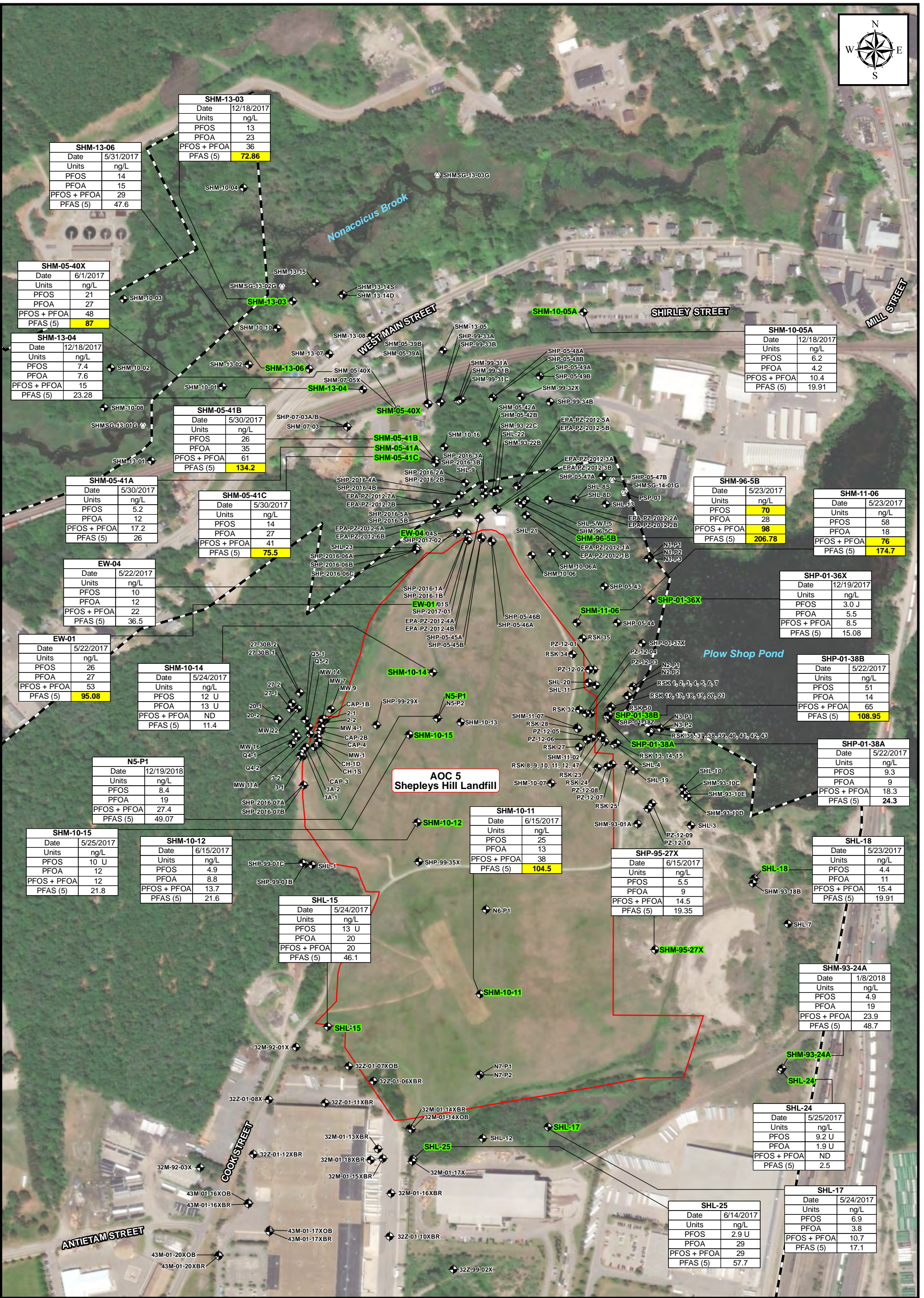


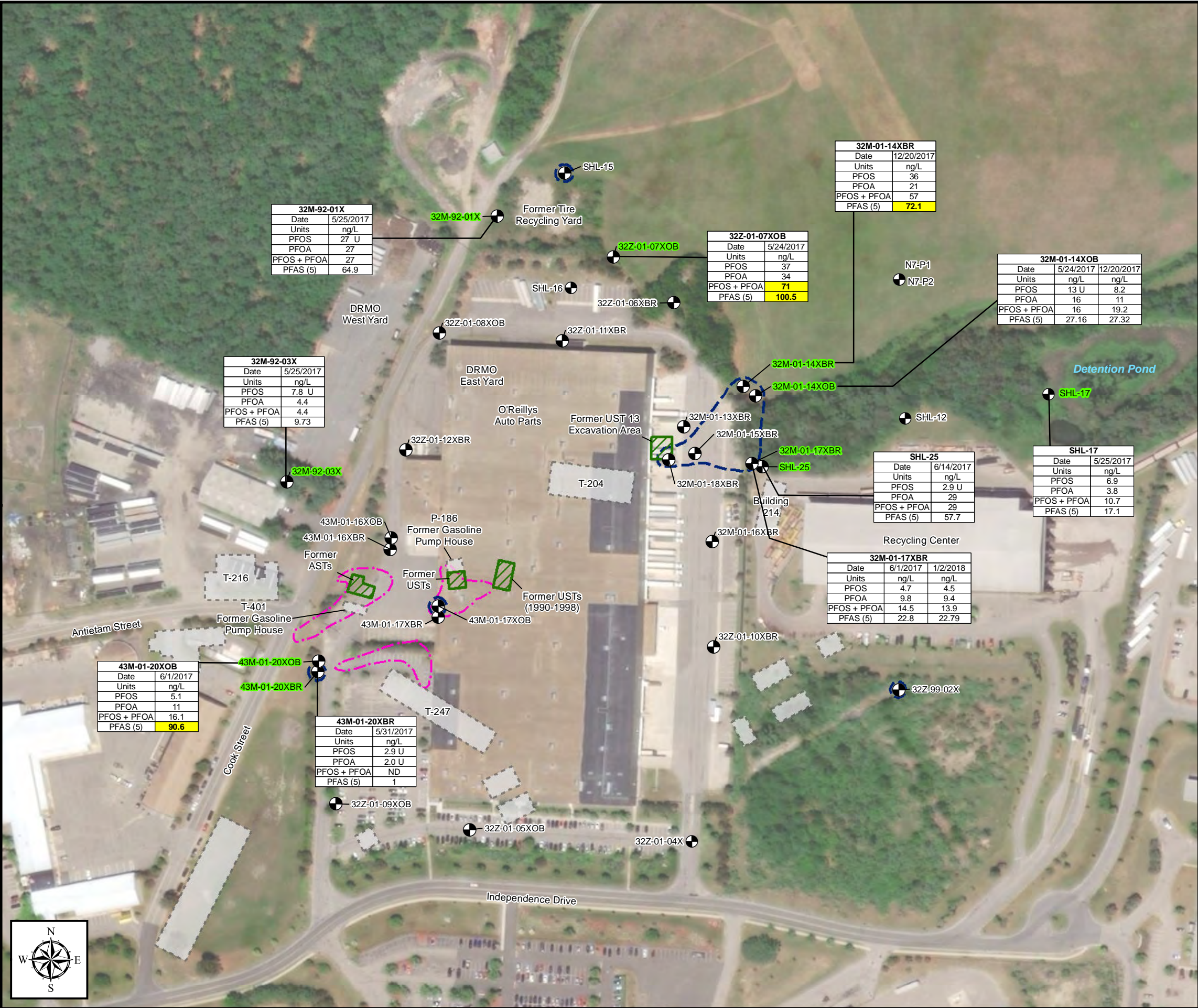
Date:
06/27/2018

Figure
3-4



File: PFAS2018_RL_WP_F3-5_AOC5_SHL_GW.mxd





Legend

- Monitoring Well
- 32M-92-01X** Sampled Monitoring Well
- Former Storage Tank(s)
- Former Building
- T-247 Former Building Number
- Approximate Historical Extent of Groundwater Contamination in Exceedance of Cleanup Goals (based on April 2002 to October 2008 analytical data) (2008 Annual Report, HGL, 2009)
- TPHC Soil Contamination

Notes:

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohexanoic Acid (PFHpA)

ng/L = nanograms per liter
J = estimated result
U = non-detect

AST = Above ground storage tank
UST = Underground storage Tank
DRMO = Defense Reutilization and Marketing Office
TPHC = Total petroleum hydrocarbons

Aerial Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

AOC 32/43A PFOS and PFOA Detections in Groundwater
Devens PFAS Remedial Investigation Workplan

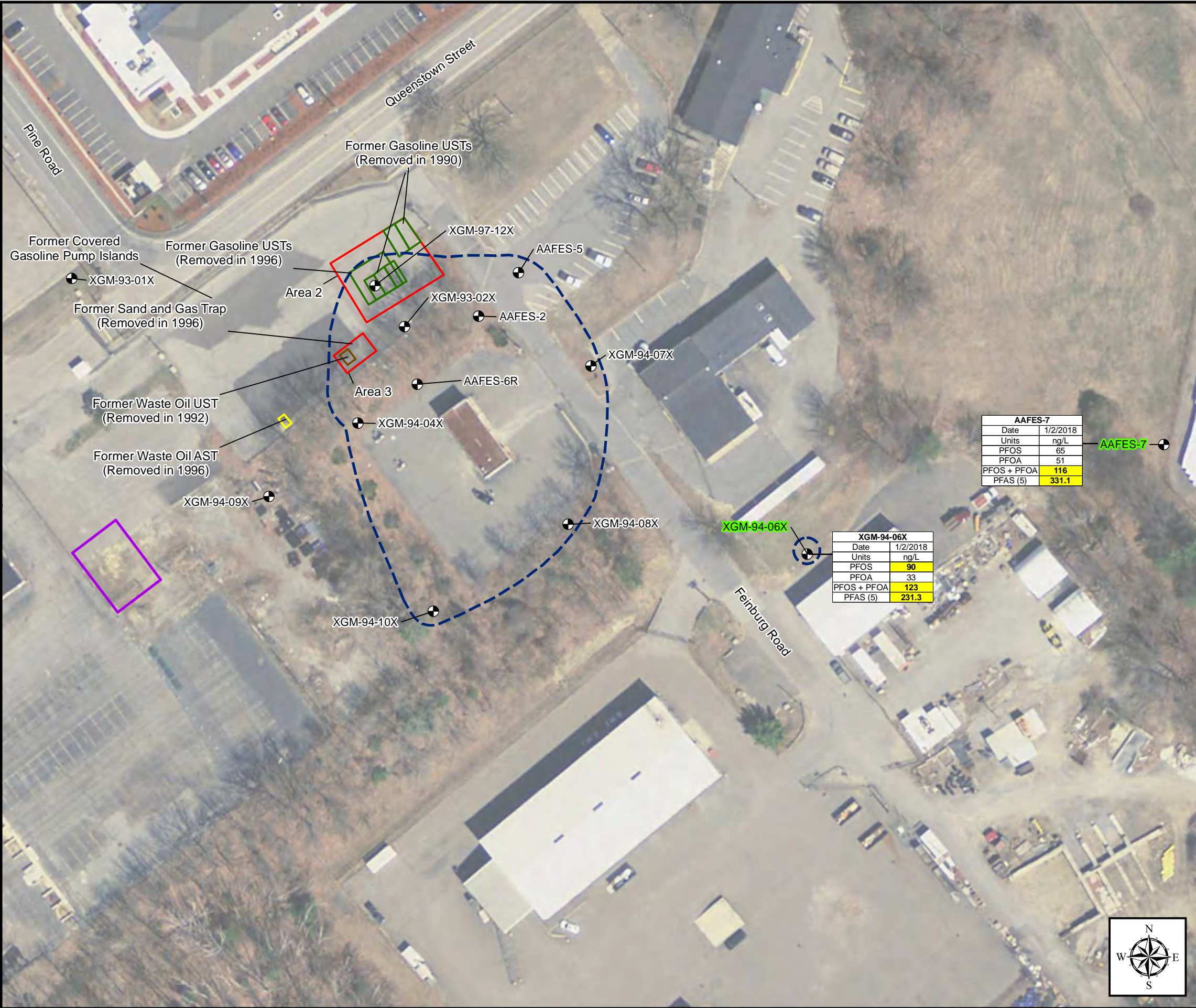
Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

0100200
Feet

Date:
06/28/2018

Figure
3-6



- Legend
- Monitoring Well
 - AAFES-7 Sampled Monitoring Well
 - Approximate Historical Extent of Groundwater Contamination in Exceedance of Cleanup Goals (based on 1999 to 2008 analytical data) (2008 Annual Report, HGL, 2009)
 - Area 1
 - Former Gasoline UST(s)
 - Former Waste Oil UST
 - Former Waste Oil AST
 - Former UST Area

Notes:

All concentrations in nanograms per liter (ng/L)
Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohexanoic Acid (PFHpA)

ng/L = nanograms per liter
J = estimated result
U = non-detect
AST = Above ground storage tank
UST = Underground storage Tank

Aerial Sources: 2013, USGS, MassGIS

AOC 43G PFOS and PFOA Detections in Groundwater
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
293 Boston Post Road West, Suite 100, Marlborough, MA 01752

04080

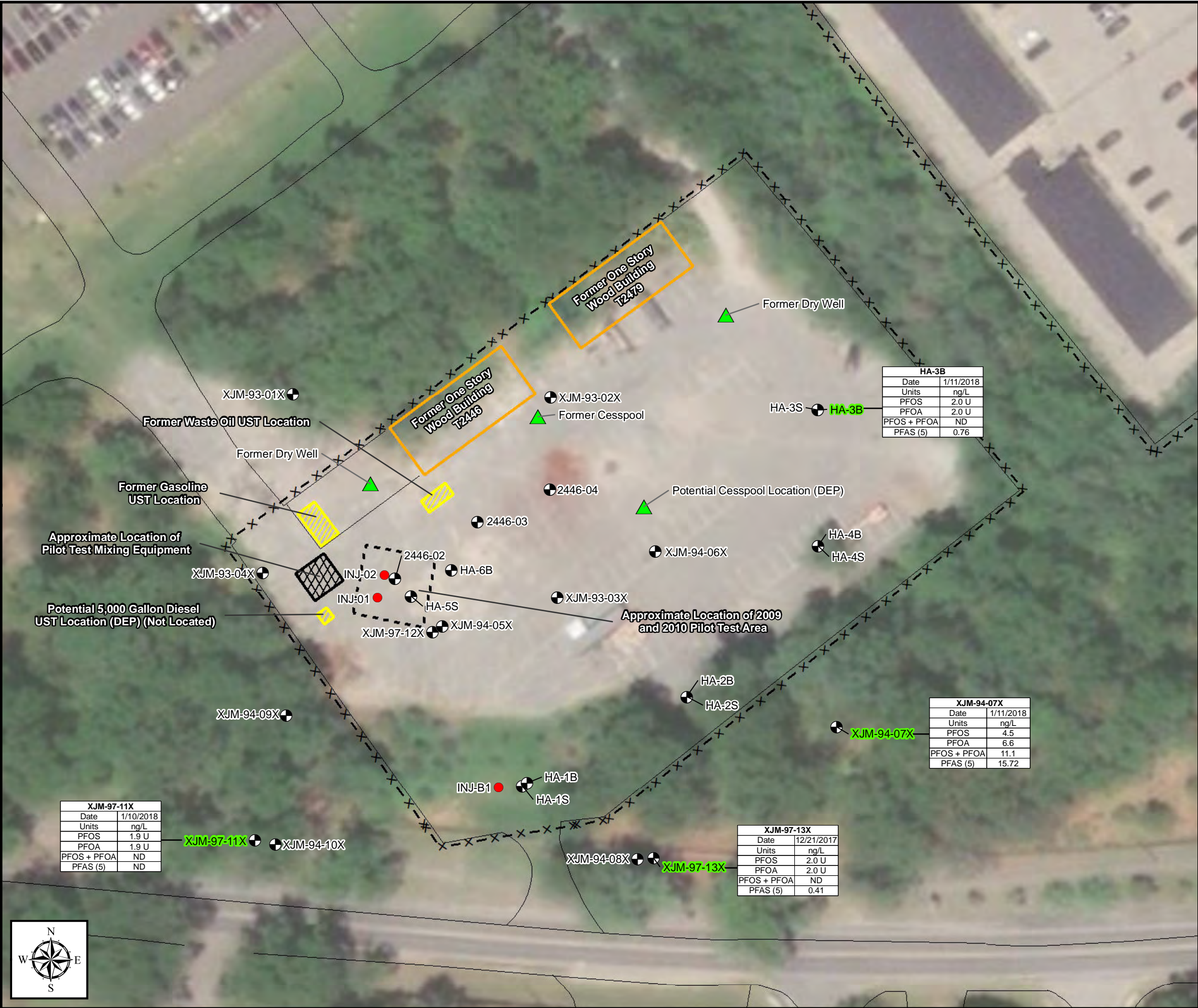
Feet

Date:

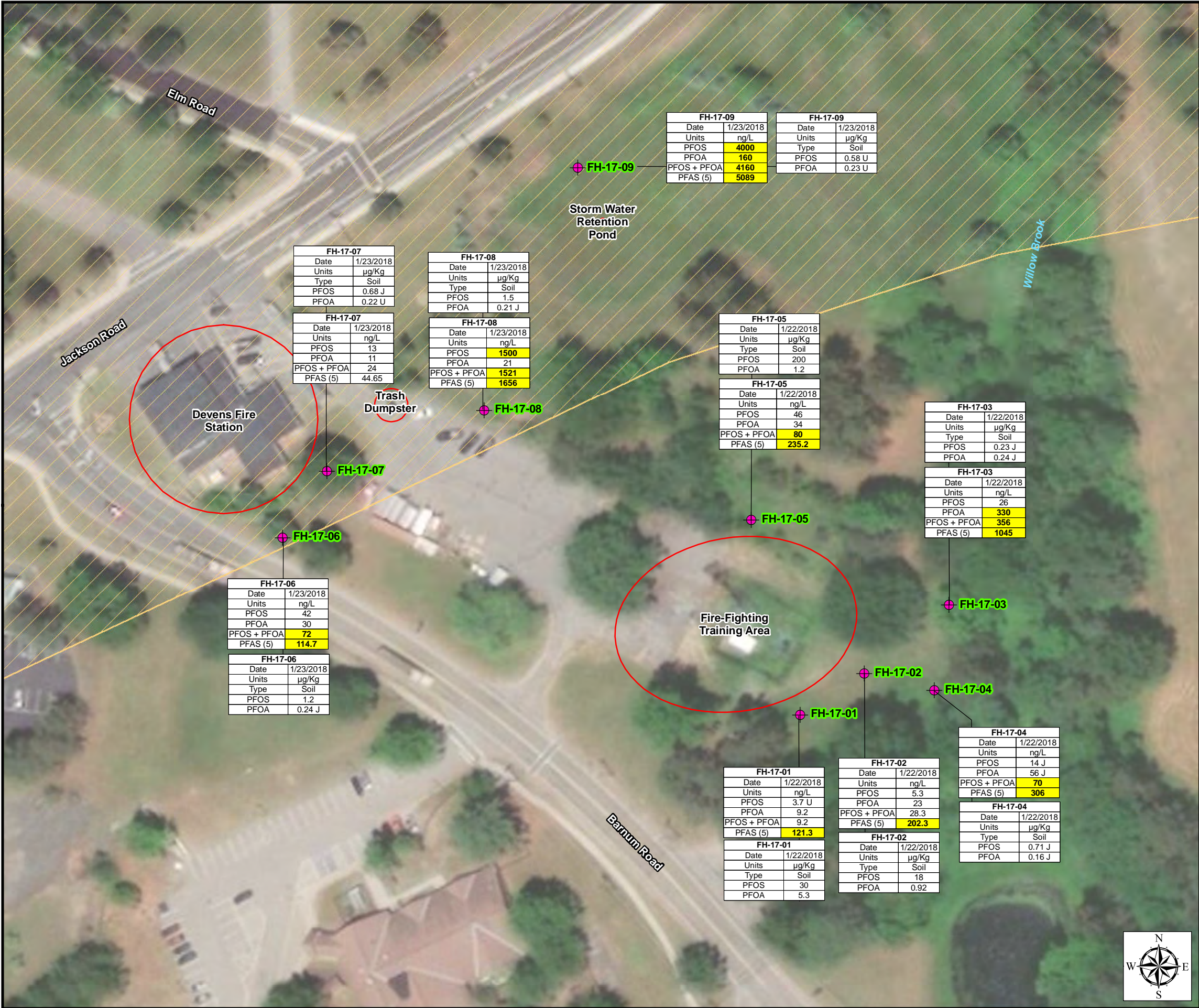
06/27/2018

Figure

3-7



File: PFAS2018_RI_WP_F3-9_AOC76_GW_SOL.mxd



Legend

- Temporary Well Location from SI
- Potential Source Area
- FH-17-01** Sampled Temporary Well
- MassDEP Zone II Wellhead Protection Area

Notes:

ng/L = nanograms per Liter
µg/Kg = micrograms per Kilogram

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

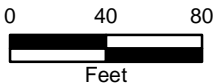
Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorohexanoic Acid (PFHpA)

J = estimated result
U = non-detect

AOC 76 PFOS and PFOA Detections in Groundwater and Soil
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

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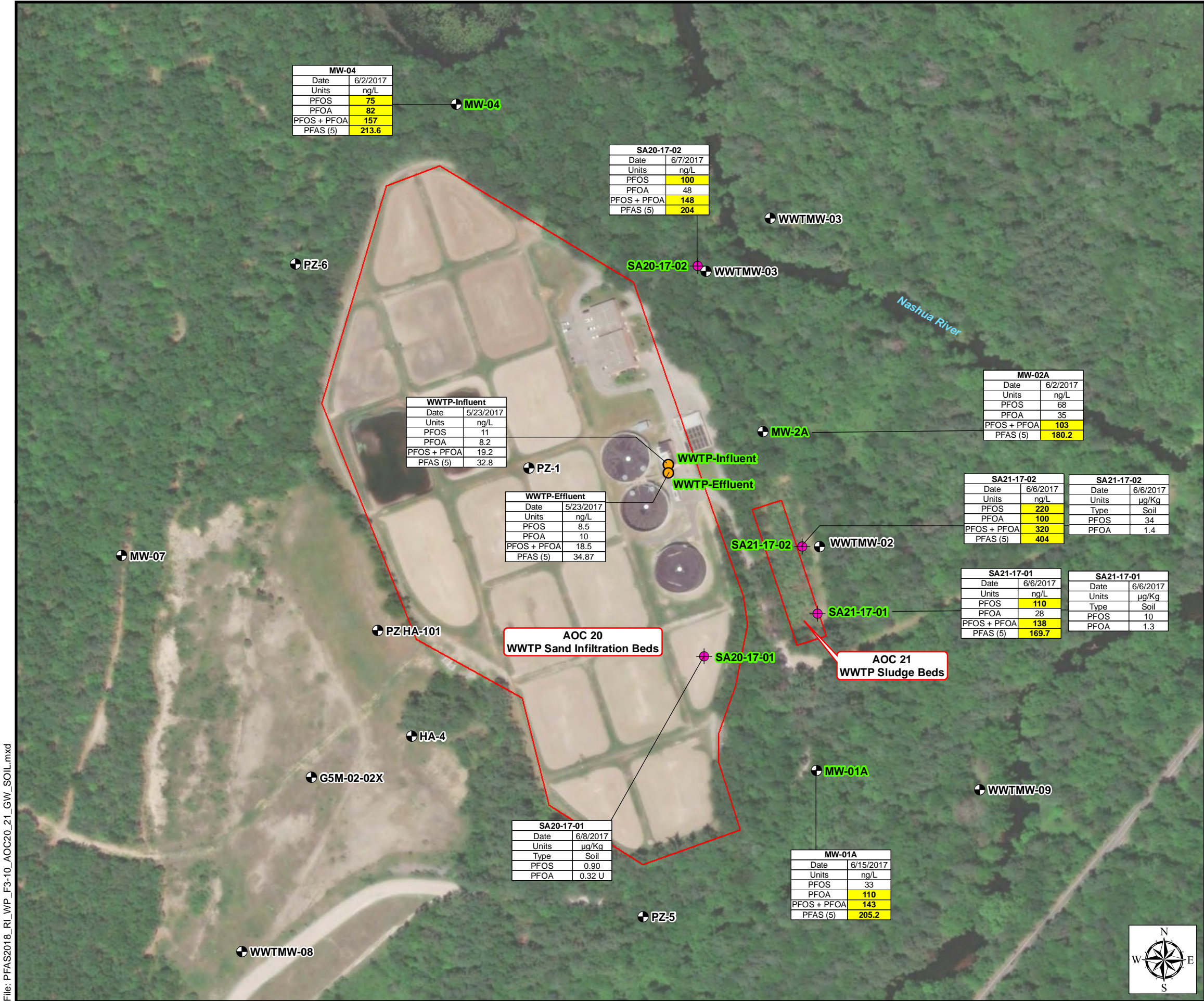


Date:
06/27/2018

Figure
3-9



File: PFAS2018_RL_WP_F3-10_AOC20_21_GW_SOIL.mxd



Legend

- Temporary Well Location from SI
- Monitoring Well Location
- Sample Location
- SA20-17-02 Sampled Monitoring Well
- Area of Contamination

Notes:

ng/L = nanograms per Liter
µg/Kg = micrograms per Kilogram
Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorhepatanoic Acid (PFHpA)

J = estimated result
U = non-detect

AOC 20 and 21
PFOS and PFOA Detections in Groundwater and Soil
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

KOMAN Government Solutions, LLC
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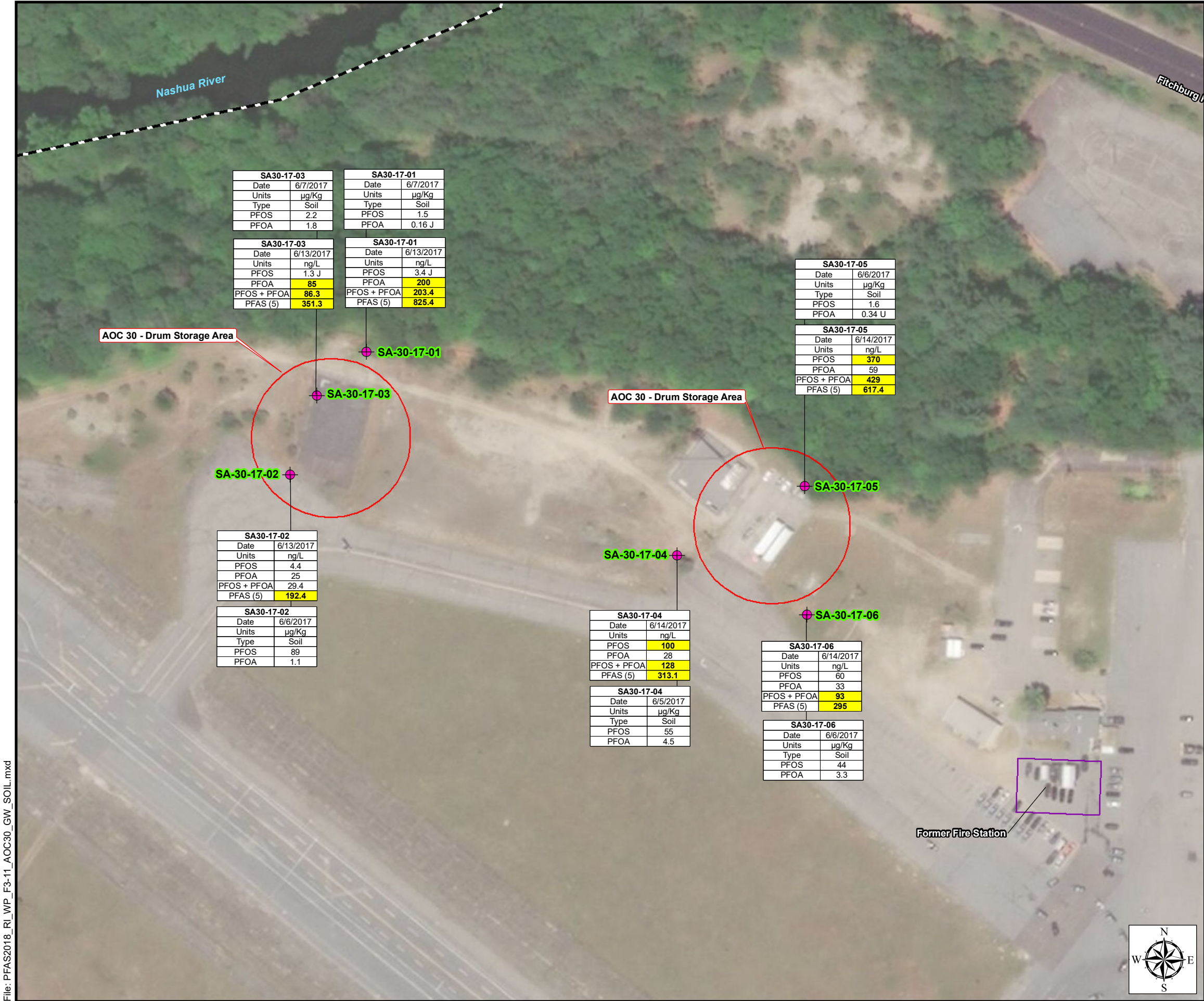


Date:
06/27/2018

Figure
3-10



File: PFAS2018_RI_WP_F3-11_AOC30_GW_SOIL.mxd



Legend

- Temporary Well Location from SI
- SA30-17-02** Sampled Monitoring Well
- Area of Contamination (AOC)
- Site Inspection Study Area Boundary
- Former Fort Devens Boundary

Notes:

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluorheptanoic Acid (PFHpA)

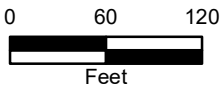
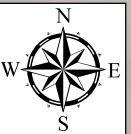
ng/L = nanograms per liter
J = estimated result
U = non-detect

µg/Kg = micrograms per Kilogram
There is no established criteria for PFOS or PFOA in soil.

AOC 30 PFOS and PFOA Detections in Groundwater and Soil
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

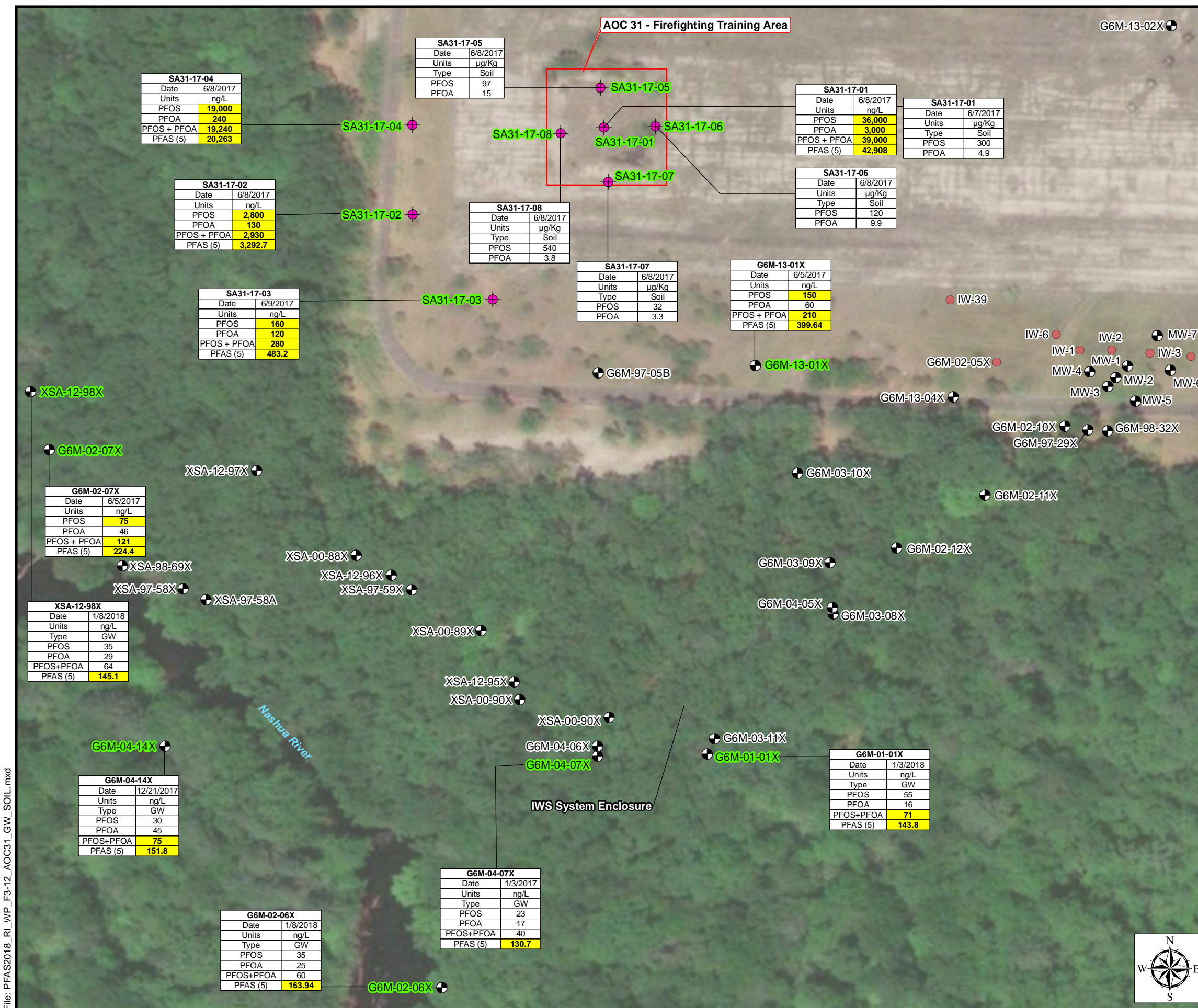
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Date:
06/27/2018

Figure
3-11





File: PFAS2018_RI_WP_F3-14_AOC50_Source_GW.mxd



Legend

Monitoring Well

Injection Well

Former Dry Well

Floor Drain

G6M-95-20X

Janitor Sink

Floor Drain Piping

Former Feature

Building Footprint

Former Fort Devens Boundary

Notes:

Bold/highlighted results exceed EPA LHA of 70 ng/L for separate or combined PFOS +PFOA and/or exceed MA ORSG of 70 ng/L for the combined concentrations of PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)
Perfluorooctanoic Acid (PFOA)
Perfluorohexane Sulfonic Acid (PFHxS)
Perfluorononanoic Acid (PFNA)
Perfluoroheptanoic Acid (PFHpA)

ng/L = nanograms per liter
J = estimated result
U = non-detect

Aerial Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

AOC 50 Source Area PFOS and PFOA Detections in Groundwater
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

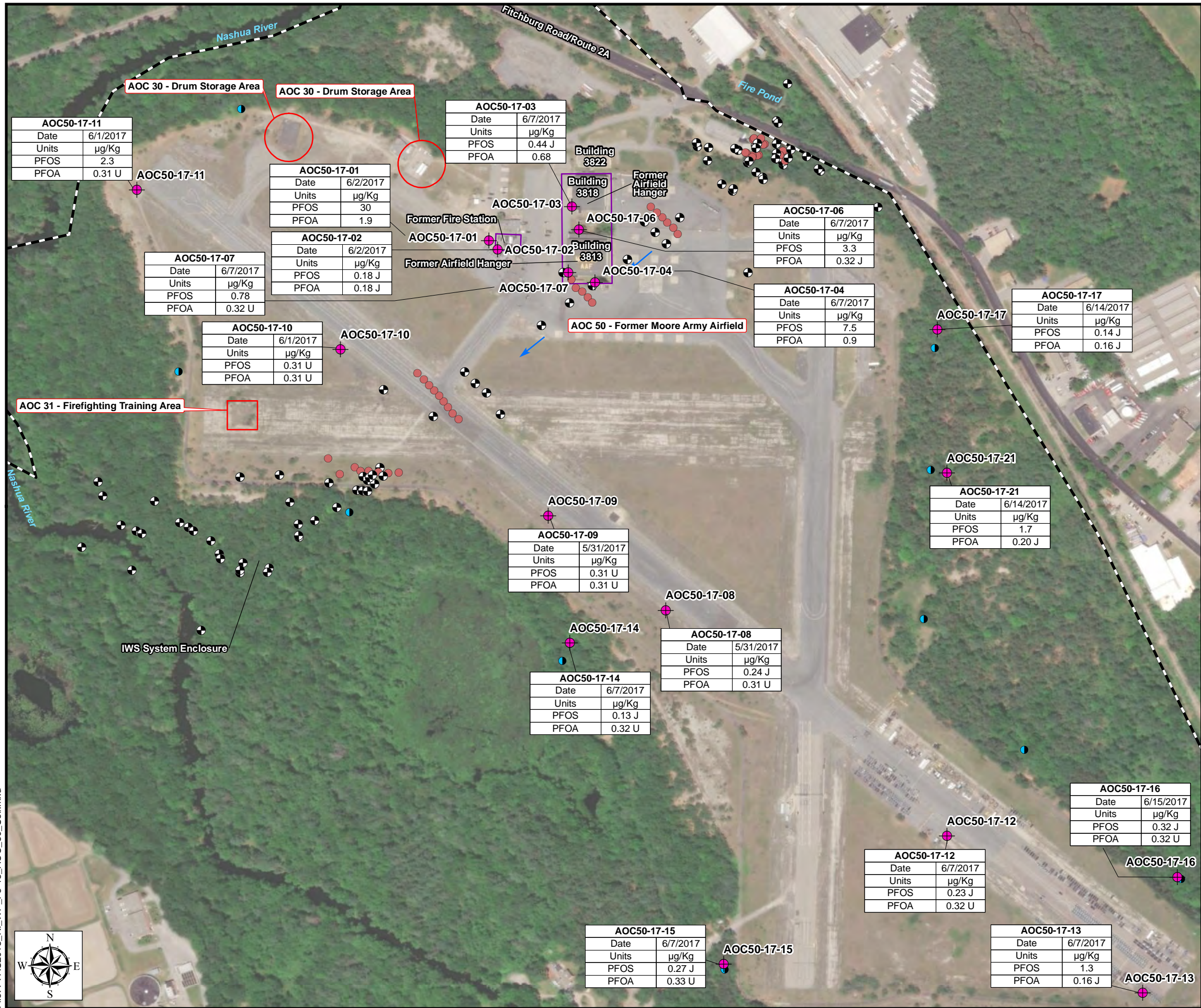
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02550
Feet

Date:
06/27/2018

Figure
3-14

File: PFAS2018_RL_WP_F3-15_AOC_50_Soil.mxd



Legend

- Temporary Well Location from SI
- Monitoring Well
- Injection Well
- Runway Stormwater Drain Outlet
- Groundwater Flow Direction
- Area of Contamination (AOC)
- Site Inspection Study Area Boundary
- Former Fort Devens Boundary

Notes:

µg/Kg = micrograms per Kilogram
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
J = Estimated Results
U = Non-Detect

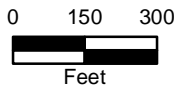
There is no established criteria for PFOS or PFOA in Soil.

PFAS in soil results at AOC 30 and AOC 31 are shown on Figure 3-11 and 3-12, respectively.

AOC 50 PFOS and PFOA Detections in Soil
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

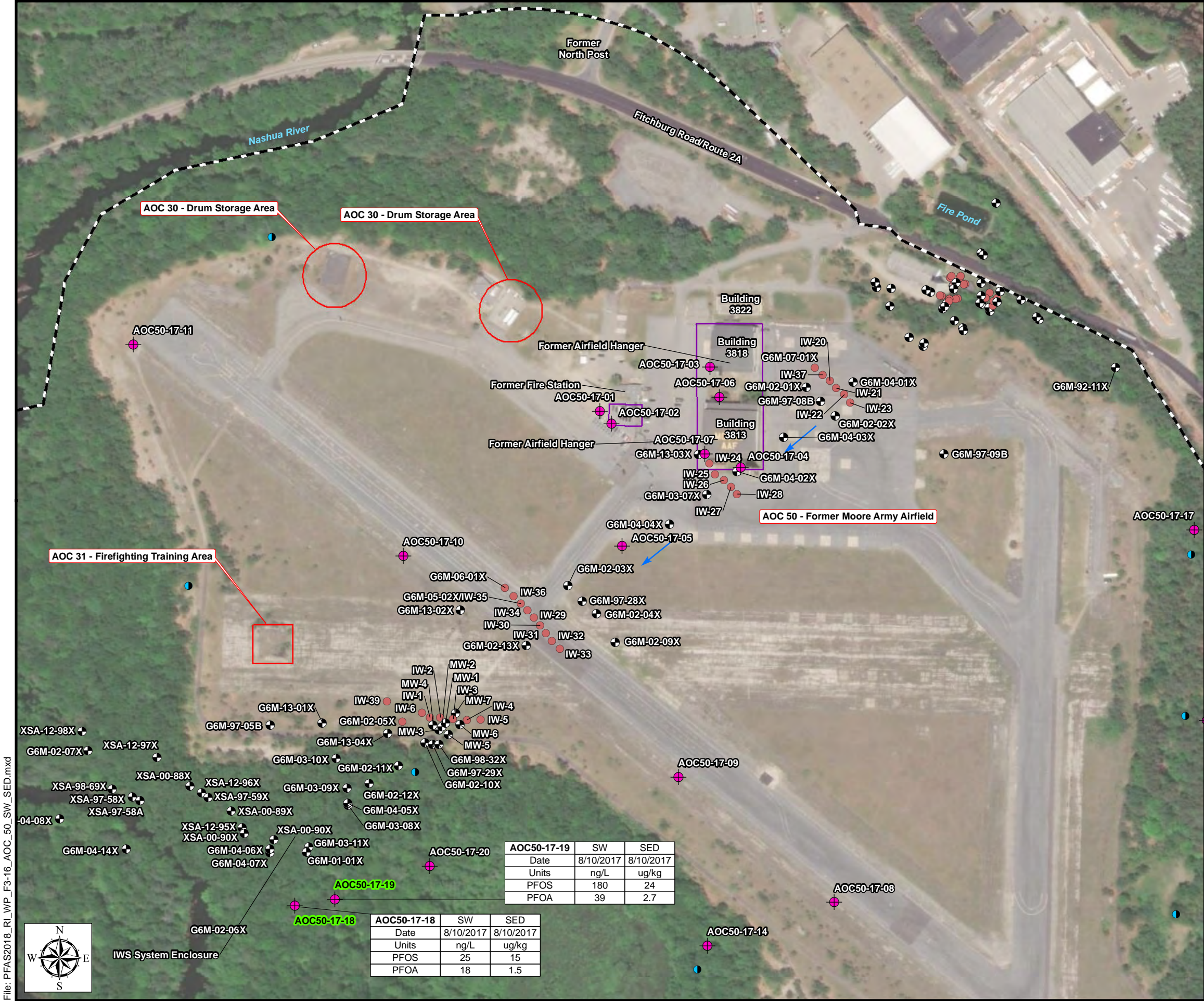
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Date:
06/28/2018

Figure
3-15





Legend

- Temporary or Sampling Well Location from SI
- Monitoring Well
- Injection Well
- Runway Stormwater Drain Outlet
- Groundwater Flow Direction
- Area of Contamination (AOC)
- Site Inspection Study Area Boundary
- Former Fort Devens Boundary

Notes:

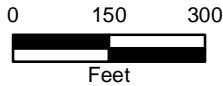
ng/L = nanograms per Liter
µg/kg = micrograms per Kilogram
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
J = Estimated Results
U = Non-Detect

Bolded/highlighted results meet or exceed EPA Drinking Water Lifetime Health Advisory of 70 ng/L for individual or sum of PFOS and PFOA.
There is no established criteria for PFOS or PFOA in surface water or sediment.

AOC 50 PFOS and PFOA
Detections in Surface Water and Sediment
Devens PFAS Remedial Investigation Workplan

Former Fort Devens Army Installation
Devens, Massachusetts

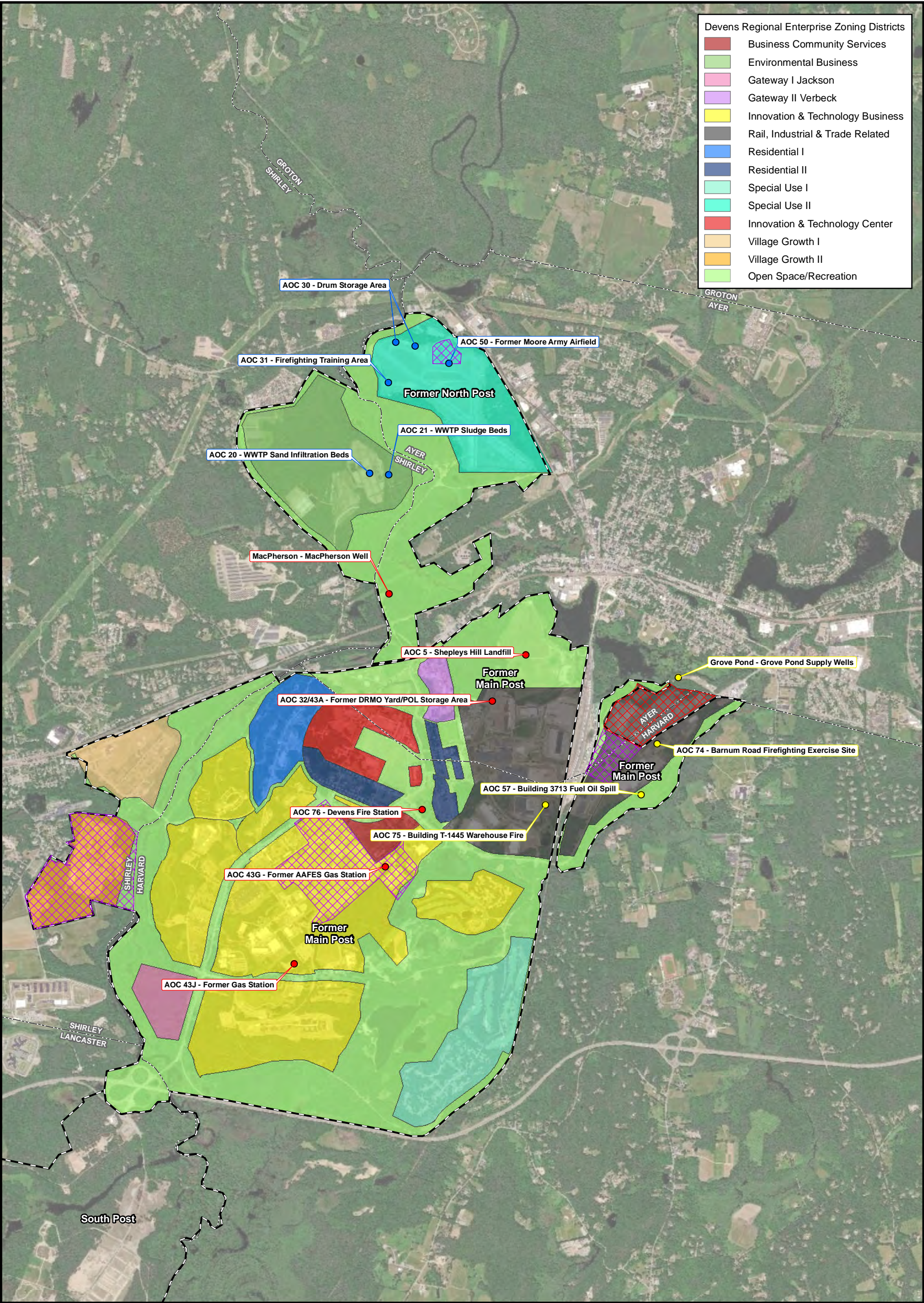
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Date:
06/27/2018

Figure
3-16





- Devens Regional Enterprise Zoning Districts
- Business Community Services
 - Environmental Business
 - Gateway I Jackson
 - Gateway II Verbeck
 - Innovation & Technology Business
 - Rail, Industrial & Trade Related
 - Residential I
 - Residential II
 - Special Use I
 - Special Use II
 - Innovation & Technology Center
 - Village Growth I
 - Village Growth II
 - Open Space/Recreation

Legend

- Area 1 - Grove Pond Supply Wells, AOCs 57, 74, and 75
- Area 2 - MacPherson Water Supply Well, SHL, AOCs 32/43A, 76, 43G and 43J
- Area 3 - AOCs 20, 21, 30, 31, and 50
- Massachusetts Army National Guard Property
- US Army Property
- City/Town Boundary
- Former Fort Devens Boundary

Devens Zoning Districts
Devens PFAS Remedial Investigation Workplan

Former Army Installation Devens
Devens, Massachusetts

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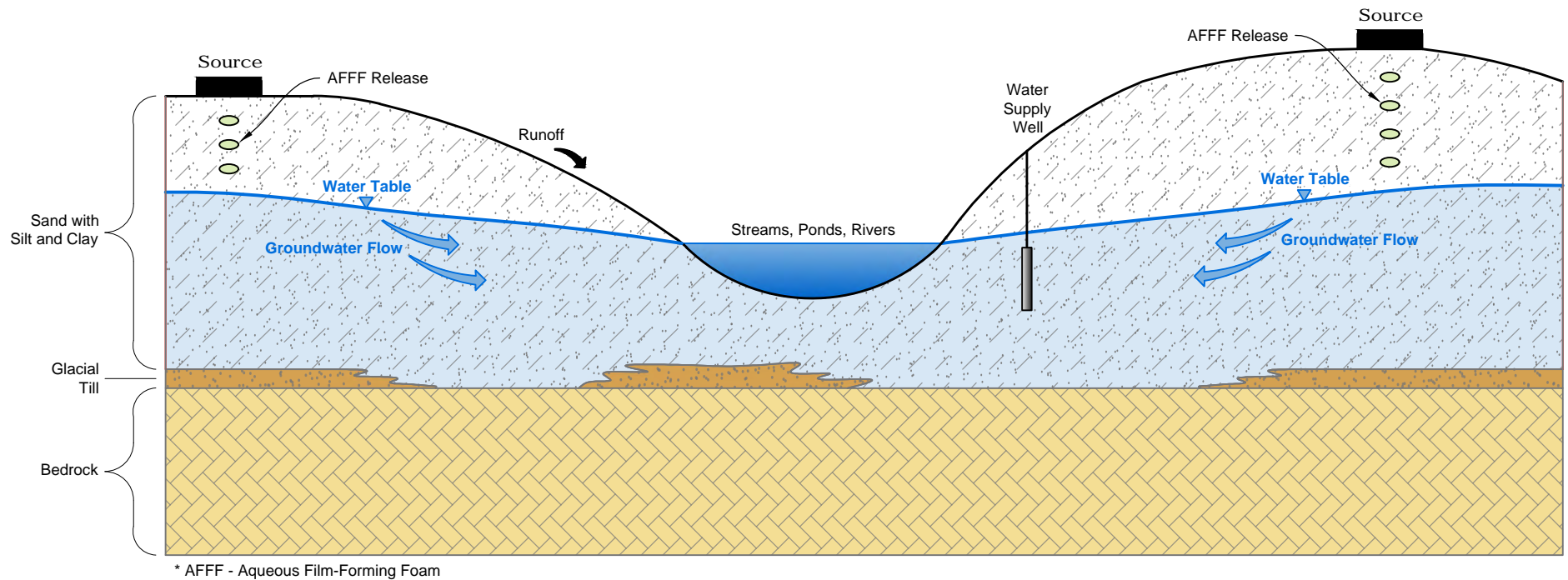
0 1,250 2,500
Feet

Date:
06/28/2018

Figure
3-17

File: PFAS2018_RL_WP_F3-17_Zoning.mxd

Devens PFAS Conceptual Model



Devans PFAS Conceptual Model
Devans PFAS Remedial Investigation Workplan

Former Army Installation Devens
Devens, Massachusetts

KOMAN Government Solutions, LLC
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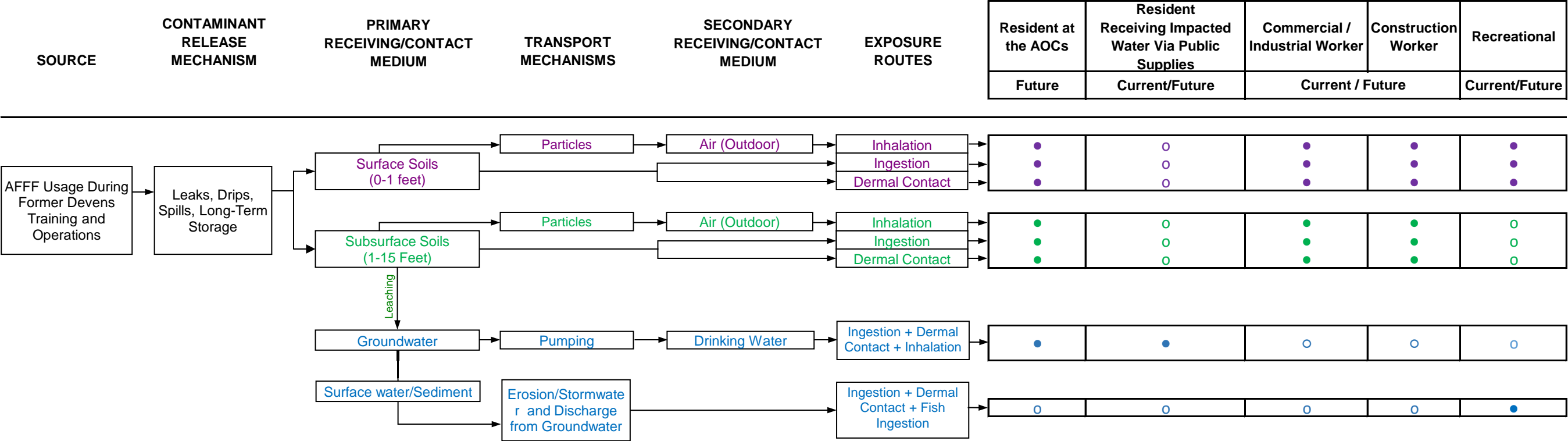
Not to Scale

Date:
06/26/2018

Figure
3-18



Figure 3-19
Human Health Exposure Assessment



Notes:

- Potentially complete exposure pathway.
- Incomplete exposure pathway.

There is no current or planned future residential exposure at the areas of contamination, but the unrestricted use pathway for soil and groundwater will be evaluated as required.

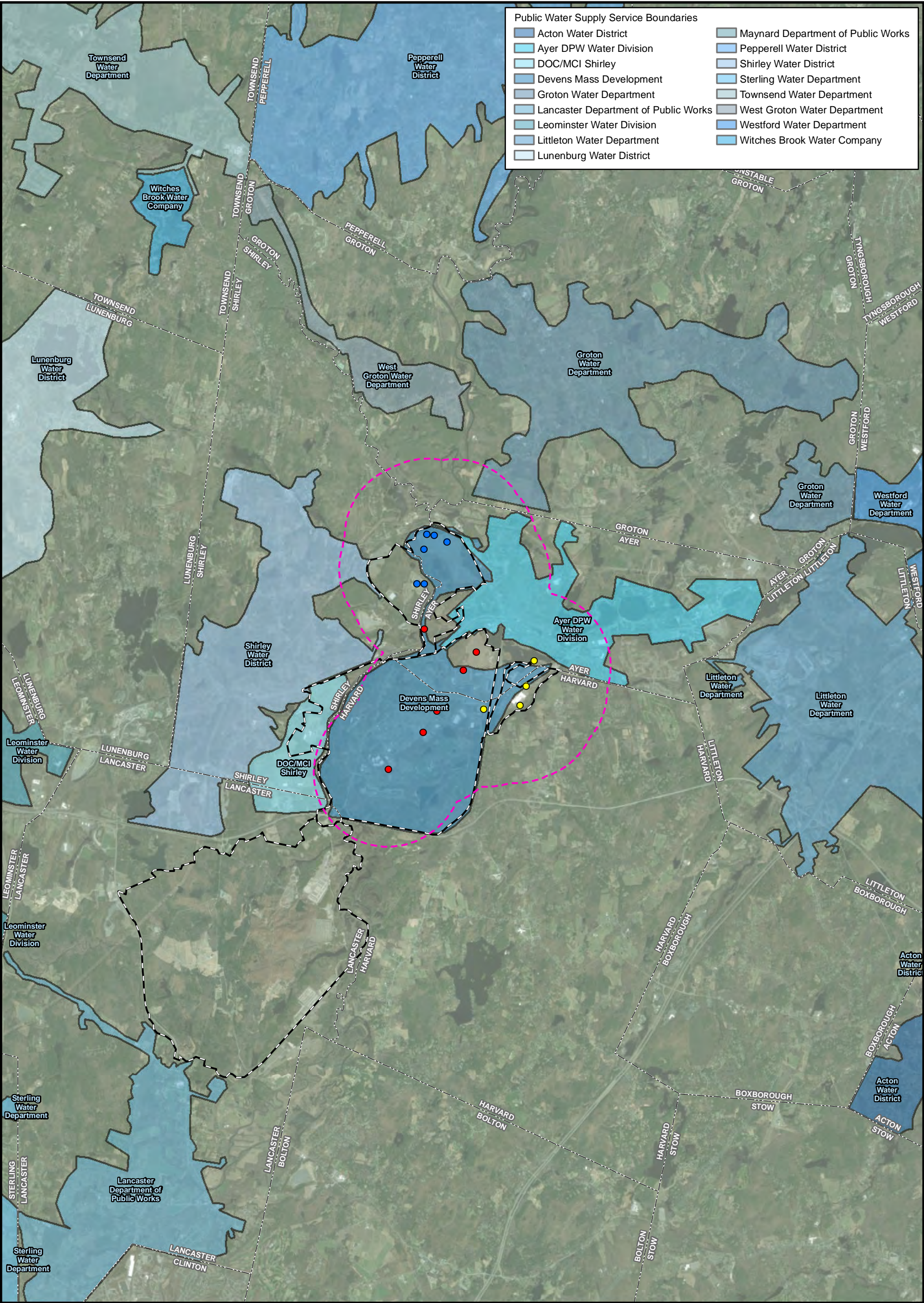
If a migration pathway from Fort Devens to a private water supply well is identified and PFAS is identified at the well, then the well will be included in the exposure assessment.

An exposure assessment via an agricultural pathway from a private or public supply well will not be conducted as lower concentrations will result in risk via a residential exposure.

Vapor and vapor intrusion is not included in the exposure assessment because the analytes are not volatile.

AOC = area of contamination

File: PFAS2018_RL_WP_F4-1_PWS_1Mile.mxd



- Public Water Supply Service Boundaries
- | | |
|--------------------------------------|------------------------------------|
| Acton Water District | Maynard Department of Public Works |
| Ayer DPW Water Division | Pepperell Water District |
| DOC/MCI Shirley | Shirley Water District |
| Devens Mass Development | Sterling Water Department |
| Groton Water Department | Townsend Water Department |
| Lancaster Department of Public Works | West Groton Water Department |
| Leominster Water Division | Westford Water Department |
| Littleton Water Department | Witches Brook Water Company |
| Lunenburg Water District | |

Legend

- Area 1 - Grove Pond Supply Wells, AOCs 57, 74, and 75
- Area 2 - MacPherson Water Supply Well, SHL, AOCs 32/43A, 76, 43G and 43J
- Area 3 - AOCs 20, 21, 30, 31, and 50
- 1-Mile Buffer
- City/Town Boundary
- Former Fort Devens Boundary

**Public Water Supply Service Areas Within 1-Mile Buffer
Devens PFAS Remedial Investigation Work Plan**

**Former Army Installation Devens
Devens, Massachusetts**

KOMAN Government Solutions, LLC
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0 0.625 1.25
Miles

Date:
06/26/2018

Figure
4-1



Table 3-1
Select Water Supply Well Results
Devens PFAS Remedial Investigation Work Plan

Location	Well ID	Date	PFOS (ng/L)	PFOA (ng/L)	PFOS+PFOA (ng/L)	PFAS (5) (ng/L)
Ayer Wells	Well #1	2/8/2018	<4	7	7	
		2/12/2018	17	8	25	
		4/23/2018	<4	6	6	12
	Well #6	9/1/2016	<4	6	6	
		11/15/2016	<4	6	6	
		1/11/2017	<4	7	7	
		4/12/2017	<4	7	7	
		8/3/2017	<4	7	7	
		10/17/2017	<4	8	8	
		1/9/2018	<4	7	7	
		4/23/2018	<4	5	5	10
	Well #7	9/1/2016	7	9	16	
		11/15/2016	6	9	15	
		1/11/2017	5	8	13	
		4/12/2017	5	7	12	
		8/3/2017	17	13	30	
		10/17/2017	14	14	28	
		1/9/2018	12	16	28	
		4/23/2018	8	8	16	34
	Well #8	9/1/2016	85	18	103	
		11/15/2016	77	17	94	
		1/11/2017	70	17	87	
		4/12/2017	80	21	101	
		8/3/2017	81	24	105	
		10/17/2017	91	23	114	
		1/9/2018	66	27	93	168
Devens Wells	MacPherson Well 03G*	7/28/2016	44	25	69	
		9/1/2016	41	21	62	
		12/28/2016	44	63	107	
		2/22/2017	46	22	68	
		5/16/2017	44	22	66	
		9/19/2017	40	21	61	
		12/19/2017	40	22	62	
		2/27/2018	39	20	59	108

Shaded data cell indicates an exceedance of the USEPA Lifetime Health Advisory [70 nanograms per liter (ng/L)] or the MassDEP Office of Research and Standard Guideline for PFAS (sum of PFOS, PFOA, PFHxS, PFNA, and PFHpA 70 ng/L).

+ = sample collected after operational change implemented

* taken out of service on (February 26, 2018 for Well 8, March 2018 for MacPherson)

PFAS (5) = sum of five PFAS compounds, specifically PFOS, PFOA, PFHxS, PFNA, and PFHpA.

Perfluorooctane Sulfonic Acid (PFOS)

Perfluorooctanoic Acid (PFOA)

Perfluorohexane Sulfonic Acid (PFHxS)

Perfluorononanoic Acid (PFNA)

Perfluoroheptanoic Acid (PFHpA)

Table 4-1
Water Supply Wells Near Devens
Devens PFAS Remedial Investigaton Work Plan

Zone II #	PWS #	PWS Well Name	PWS Well Address
2115001	2115001-02G	West Groton Water Supply District	West Main Street, Groton 01450
2139000	2270000-03G	Patterson Road WTP (Treated)	Shirley
2139000	2270000-04G	Walker Well WTP (Treated)	Shirley
2019001	2019001-03G	Macpherson Well: Finished Water	Devens
2019001	2019001-04G	Grove Pond Well 4	45 Barnum Road, Devens 01434
4310000	2019000-08G	Grove Pond Well 8	
4310000	2019000-07G	Grove Pond Well 7	
4310000	2019000-06G	Grove Pond Well 6	
4310000	2019000-02G	Grove Pond Well 2	
4310000	2019000-01G	Grove Pond Well 1	
2323000	2019001-05G	Patton Replacement Well	Devens
2323000	2019001-06G	Shabokin Replacement Well	Devens
2323000	2019001-02G	Shabokin Gravel Packed Well	Devens
227001	227001-01G	MCI-Shirley Well 1	Shirley Rd and Shaker Rd, Lancaster 01523
227001	227001-02G	MCI-Shirley Well 2	
Zone I only	2125007-01G	The Appleworks	325 Ayer Road, Harvard 01451
	2125010-01G	Harvard Plaza	275-285 Ayer Road, Harvard 01451
	2125013-01G	Foxglove Apartments	253 Ayer Road, Harvard 01451
	2125020-01G	Shaker Place Offices	233 Ayer Road, Harvard 01451
	2125003-01G	Jill Realty Trust	231 Ayer Road, Harvard 01451
	2125012-01G	Vanguard Medical/Renaissance (also called Concord Hillside Medical Association) (Also called Lancaster County Road Llc)	12-16 Lancaster County Road Harvard 01451
	2147006-03G	Range Control Well 3	US Army South Post, Lancaster
	2125015-04G	Fruitlands Museum	102 Prospect Hill Road, Harvard 01451
	2125015-01G	Fruitlands Museum Well 1	
	2125021-01G	Ayer Road Properties LLC Well 1	69 Lancaster County Road, Harvard 04151
	2125021-02G	Ayer Road Properties LLC Well 2	
	2125021-03G	Ayer Road Properties LLC Well 3	
	2125021-04G	Ayer Road Properties LLC Well 4	
	2125014-01G	Harvard Green Condominiums Well 1	35 Lancaster County Rd, Harvard 01451
	2125014-02G	Harvard Green Condominiums Well 2	
	2125004-01G	Offices at Harvard Park LLC, Well 1	Harvard
	2125004-02G	Offices at Harvard Park LLC, Well 2	
	2125004-03G	Offices at Harvard Park LLC, Well 3	
	2125005-01G	Village Nursery School Well 1	40 Poor Farm Road, Harvard 01451

PWS = public water supply well



APPENDIX A

Quality Assurance Program Plan



APPENDIX B

Responses to Comments (reserved)